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TECHNICAL SPECIFICATIONS



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**SECTION 01001
GENERAL REQUIREMENTS**

PART 1 - GENERAL

1.01 COMMENCEMENTS AND PROSECUTION OF WORK

- A. Contract time shall begin at which time the Owner will issue a written Notice to Proceed. The Contractor must commence construction within ten (10) days of issuance of a written Notice to Proceed. The Contractor shall maintain sufficient labor and supervision on the job until all items have been completed and the Engineer's Final Certification has been issued.

1.02 COOPERATION

- A. The General Contractor and Sub-Contractors shall cooperate with one another and with other Contractors doing related work and shall coordinate their work with the work of other trades and other Contractors so as to facilitate the general progress of the work. Each trade shall afford all other trades and all other Contractors every reasonable opportunity for the installation of their work and for storage of their materials.

1.03 SANITARY FACILITIES, TEMPORARY

- A. Do not allow any sanitary nuisances to be committed in or about work; enforce sanitary regulations of Local and State Health authorities.

1.04 SITE EXAMINATION OF EXISTING CONDITIONS

- A. The Contractor, in undertaking the work under this Contract, is assumed to have visited the premises and to have taken into consideration all conditions which might affect his work. No consideration will be given any claim based on lack of knowledge of existing conditions, except where the Contract Documents make definite provisions for adjustment of cost or extension of time due to existing conditions which cannot be readily ascertained.

1.05 SPECIFICATIONS EXPLANATION

- A. Attention is directed to the fact that the detailed specifications and separate sections may be written in short or abridged form. In regard to every section of the specifications and all parts thereof, mentioned therein or indications on the drawings or articles, materials, operations, or methods required that the Contractor:
 - 1. Provide each item mentioned and indicated (of quality or subject to qualifications notes).
 - 2. Perform (according to conditions stated) each operation prescribed.
 - 3. Provide therefore all necessary labor, equipment, and incidentals.

- B. Wherever in these specifications or on the drawings the words "directed", "required", "ordered", or words of like import are used, it shall be understood that the directions, requirements, permission, or order of the Engineer is intended; and similar words "approved", "accepted", "satisfactory", or words of like import shall mean approved, acceptable to, or satisfactory to the Engineer.
- C. For convenience of reference and to facilitate the letting of Contracts or Sub-Contracts, these specifications are separated into titled sections. Such separation shall not, however, operate to make the Engineer an arbiter to establish limits to the Contracts between the Contractor and Sub-Contractors, nor shall such operation be interpreted as superseding normal union functions.
- D. Notwithstanding the appearance of such language in the various divisions of the specifications as "The Electrical Contractor", "The Roofing Contractor", etc., the Contractor is responsible to the Owner for the entire Contract and the execution of all work referred to in the Contract Documents.

1.06 STANDARD

- A. Wherever reference is made to the standard specifications of nationally known organizations and specific articles, sections, divisions, or headings are not given, such specifications shall apply in full. Standard specifications where included herein by abbreviation or otherwise shall form a part of this specification the same as if quoted in full.
- B. The Engineer may require, and the Contractor shall furnish if required to do so, certificates from manufacturers to the effect that the products or materials furnished by them for use in the work comply with the applicable specified requirements for the materials or products being furnished.

1.07 TELEPHONE, TEMPORARY

- A. Contractor shall provide mobile telephone numbers for the Project Superintendent and Project Foreman either prior to or during the Preconstruction Meeting.

1.08 TEMPORARY UTILITIES

- A. Contractor shall furnish water, electricity, and heating fuel necessary for construction. Contractor shall provide necessary temporary piping, faucets, valves, wiring, switches, outlets, etc., to carry services to the work. The Contractor shall make all temporary utilities connection for his own use and remove temporary services on completion of Contract.

1.09 WORK OUTSIDE OF THE PROPERTY LINE

- A. All work outside of the property line called for by the Contract Documents shall be performed by the Contractor and all cost for same shall be included in the Contract.

1.10 AS-BUILT DRAWINGS

- A. The Contractor shall, upon completion of the work, furnish a marked set of drawings showing field changes affecting the various mechanical trades, utilities and electrical, as actually installed and as specified under those sections of the

specifications, and deliver them to the Engineer. Engineer will furnish prints to Contractor for marking.

1.11 LIQUIDATED DAMAGES

- A. Substantial Completion - If the Contractor neglects, fails or refuses to achieve Substantial Completion of the work by not later than 12 A.M. (Midnight), the Contractor shall pay to the Owner, Liquidated Damages in the amount of three hundred dollars (\$300.00) per calendar day for each and every day that the Contractor is in default after the date indicated on the Notice to Proceed.
- B. Final Completion - If the Contractor neglects, fails, or refuses to complete the work by not later than 12 A.M. (Midnight), the Contractor shall pay to the Owner, Liquidated damages, in the amount of three hundred dollars (\$300.00) per calendar day for each and every day that the Contractor is in default after the date indicated on the Notice to Proceed. Liquidated Damages for Substantial Completion and Final Completion are cumulative.
 - 1. The said amount is fixed and agreed upon by and between the Contractor and the Owner because of the impracticability and extreme difficulty of fixing and ascertaining the actual damages the Owner would in such an event sustain, and said amount is agreed to be the amount of damages which the Owner would sustain and said amount shall be retained from time to time by the Owner from current Progress Payment should the construction progress fall behind schedule.
 - 2. Time is of the essence of each and every portion of this Contract and of the specification wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the Contract an additional time is allowed for the completion of any work, the new time limit fixed by such extension shall be of the essence of this Contract.
 - 3. Extensions of time applies to Liquidated Damages only and shall be allowed only for conditions over which the Contractor has no control, such as acts of God, transportation strikes affecting delivery of materials or equipment which are used in the project, manufacturing strikes affecting the production of materials or equipment which are used in the project, and weather above and beyond the normal expected loss of time based on historical climatological conditions over the last 10 years. For any time requested over what should be expected based on historical climatological conditions the amount of rain or temperature must meet the following conditions. To get credit for delays due to temperature the temperature must at a level that would prevent construction in accordance with the other sections in these specifications. In order to get credit for rain delay the rain event must be persistent for more than four hours during that day and rainfall must be in excess of 0.5" for that 4-hour period or more than 1" during the day.

1.12 MATERIALS PRIOR APPROVAL AND SUBSTITUTIONS

- A. Where items of equipment and/or materials are specifically identified herein by a manufacturer's name, model, or catalog number, only such specific item may be used in the base bid, except as hereinafter provided.

- B. If Contractors wish to use items of equipment and/or materials other than those specifically identified in the Specifications, Contractor shall apply in writing to the Engineer for approval of substitution at least seven (7) days prior to opening of bids, submitting with his request for approval complete descriptive and technical data on the item(s) he proposes to furnish.
- C. Approved substitutions will be listed in an addendum issued to all General Contractors prior to opening of bids.
- D. Unless requests for changes in the Specifications are approved prior to the opening of bids, as defined above, the successful Contractor will be held to furnish specified items. After contract is awarded, changes in specifications will be made only as defined under "Substitution of Equipment".

1.13 SUBSTITUTION OF EQUIPMENT AND MATERIALS

- A. After execution of contract, substitution of equipment and/or materials other than those specifically named in the Contract Documents will be approved by the Engineer for the following reasons only:
 - 1. That the equipment or material is no longer available.
 - 2. That the equipment or material does not perform the function for which it was intended.
 - 3. That the equipment or material cannot be delivered due to conditions beyond the Contractor's control.
- B. To receive consideration, requests for substitutions must be in writing accompanied by documentary proof of equality, and difference in price and delivery, if any.
- C. In case of a difference in price, the Owner shall receive all benefit of the difference in cost involved in any substitutions, and the contract altered by change order to credit the Owner with any savings so obtained.

1.14 INSPECTING AND TESTING OF MATERIALS

- A. Wherever in these Contract Documents inspecting and testing of material is called for, the selection of bureaus, laboratories and/or agencies for such inspecting and testing shall be made by the Engineer, and the character of the test shall be stipulated by the Engineer. Documentary evidence satisfactory to the Engineer that the materials have passed the required inspection and tests must be furnished in quadruplicate to the Engineer by the bureau, agency or laboratory selected. Materials satisfactorily meeting the requirements of the inspection or tests shall be approved by the Engineer and the Contractor notified of the results. The cost of such inspecting and testing shall be paid for by the Contractor.

1.15 ON SITE TESTING AND INSPECTING

- A. Wherever in these Contract Documents testing or inspecting is called for, the selection of bureaus, laboratories and/or agencies for such testing or inspecting shall be made by the Engineer. Documentary evidence satisfactory to the Engineer that the materials have passed the required tests or inspections shall be furnished

in quadruplicate to the Engineer. **The cost of such tests and inspection shall be paid for by the Contractor.**

1.16 MEASUREMENTS AND DIMENSIONS

- A. Before ordering materials or doing work which is dependent for proper size of installation upon coordination with site conditions, the Contractor shall verify all dimensions by taking measurements at the site and shall be responsible for the correctness of same. No consideration will be given any claim based on differences between the actual dimensions and those indicated on the drawings. Any discrepancies between the drawings and/or specifications and the existing conditions shall be referred to the Engineer for adjustment before any work affected thereby is begun.

1.17 SHOP DRAWINGS

- A. Shop drawings shall be dated and contain: Name of project; description and names of equipment, materials, and items; and complete identification of locations at which material or equipment is to be installed, reference to the section of the specifications where it is specified and drawings number, where shown. In addition to the above, the Shop drawings shall: (1) show complete information for checking and for fabrication, installation and erection, without reference to other drawings or note; (2) shall be of drafting line work and lettering that is easily readable under field conditions; (3) have plane oriented the same as plans on the Contract Drawings; (4) list grade, class, or strength of materials; (5) be checked and initialed by the suppliers drafting room checker; (6) be checked and coordinated with other phases of the work, by a person in the Contractor's employ who is experienced and qualified in the checking and coordination of shop drawings.
- B. Shop drawings shall not, after having been submitted, be later issued with revised or additional materials, except for items corrected during the checking by the Contractor or reviewed by the Engineer.
- C. The following notation will be used by the Engineer in his review.
 - 1. No exceptions taken. (If checked here, fabrication may be undertaken. Approval does not authorize change to contract sums unless stated in a separate letter or by change order.)
 - 2. Note markings. (If checked here, fabrication may be undertaken. Contractor is to coordinate markings noted.)
 - 3. Revise and resubmit.
 - 4. Rejected.
 - 5. Engineer review is for conformance with the design concept of the project and compliance with the information given within the Contract Documents only. The Contractor is responsible for dimensions being confirmed and correlated at the site; for information that pertains solely to the fabrication processes or to means, method, techniques, sequence, and procedures of construction; and for coordination of the work of all trades.

6. Failure to note a noncompliance will not prevent later rejection when the noncompliance is disclosed.
- D. Submission of Shop drawings shall be accompanied by a transmittal letter in duplicate, containing project name, Owner's project number, Contractor's name, and number of drawings, title, and other pertinent data.
- E. The Contractor shall promptly submit to the Engineer, five copies for Architectural items and six copies for Engineering items, required by the Contract Documents in accordance with the aforesaid schedule so as to cause no delay in his work or in work of any other Contractor.
- F. For standard items not requiring special shop drawings for manufacture, submit six copies of manufacturer's product data showing illustrated cuts of the items to be furnished, scaled details, size dimensions, performance characteristics, capabilities, wiring diagrams, control, and all other pertinent information.
- G. The Contractor shall: (1) check, coordinate, correct, stamp, date, and sign all copies of each drawing, and deliver them to the Engineer for his review; (2) identify the set of drawings he has checked; this set shall be shown by checked marks or correction that every item has been verified and with the requirements of the Contract Documents.

1.18 MAINTENANCE MANUAL

- A. Contractor shall, prior to completion of contract, deliver to the Engineer, three copies of manual, assembled and bound with a hard cover, for the Owner's guidance, full details for care and maintenance of visible surfaces and of equipment included in contract.
- B. Contractor shall, for this manual, obtain from subcontractor, literature of manufacturers relating to equipment, including motors; also furnish cuts, wiring diagrams, control diagrams, instruction sheets and other information pertaining to same that will be useful to Owner in overall operation and maintenance.
- C. Where the above-described manuals and data are called for under separate sections of the specifications, they are to be included in the manual description in this article.

1.19 ELECTRONIC MEDIA

- A. Contractor may request an electronic file of construction plans in its native AutoCAD format for convenience during construction. The initial cost for preparation of the file shall be \$1,000.00, due prior to receipt of the file. Contractor must subscribe to obtain all updates to the file when and if plans are modified. The cost for each update provided to the Contractor shall be \$200.00. Prior to receipt of file, the Contractor must execute an Indemnification Agreement with P.C. Simonton and Associates, Inc. Transmission of the file to, or use by, any third party is prohibited.

END OF SECTION

**SECTION 02100
CLEARING AND GRUBBING**

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Clearing shall consist of the felling, trimming, cutting and disposal of trees and other vegetation designated for removal, including down timber, snags, brush, and rubbish occurring within the area to be cleared. Grubbing shall consist of the removal and disposal of stumps, roots larger than 1.5 inches in diameter and matted roots.

PART 2 - EXECUTION

- 2.01 Trees, down timber, stumps, roots, brush, and other vegetation in areas to be cleared shall be removed completely, except such trees and vegetation as may be indicated or directed to be left standing. Trees to be left standing within the cleared areas shall be trimmed of dead branches 1.5 inches or more in diameter.
- 2.02 Limbs and branches to be trimmed shall be neatly cut close to the bore of the tree or main branches. Cuts more than 1.5 inches in diameter shall be painted with commercial tree-wound paint.
- 2.03 All organic materials, masonry, concrete, or metallic debris in the clearing and grubbing areas shall be excavated and removed to a depth of not less than 12 inches below grade where original grade is to remain level and two feet below finish grade, bottom of pavement base and bottom of footings.
- 2.04 Depressions made by grubbing shall be backfilled and compacted with fill material to meet the requirement for trenching and structural backfilling.
- 2.05 Machine grubbing shall not be done under trees left standing in the area covered by the branches, nor in any manner which might damage the trees or any new work.
- 2.06 Trees and vegetation to be left standing shall be protected from damage during clearing, grubbing and construction operations, by the erection of barriers.
- 2.07 Damages caused by the execution of clearing and grubbing shall be paid for by the Contractor.
- 2.08 Objects above or below grade interfering with construction to be removed as directed by the Engineer.
- 2.09 DISPOSAL OF MATERIALS
 - A. Cleared and grubbed materials to be disposed of to an approved off-site disposal area.
 - B. On site burning will not be allowed, without written permission of local authorities.

END OF SECTION

**SECTION 02210
SITE GRADING**

PART 1 – GENERAL

1.01 QUALITY ASSURANCE

A. Reference Standards:

1. Standards of American Society for Testing and Materials:

ASTM-D-698 Moisture-Density Relations of Soils Using 5.5 lb. (2.5 KG) Hammer and 12 inch (304.8 mm) Drop.

2. Methods of Sampling and Testing of American Association of State Highway and Transportation Officials (AASHTO), latest edition.

1.02 TESTING

A. All soil testing shall be performed by an Independent Testing Laboratory selected by the Engineer and paid for by the Contractor.

1.03 EXCESS EXCAVATED MATERIALS

A. Excess excavated materials shall be wasted off site by the Contractor at no expense to Owner, or as directed by the Engineer.

1.04 BORROW MATERIAL

A. Any borrow material required to accomplish all levels, lines and grades indicated shall be furnished by the Contractor at no expense to the Owner.

B. Borrow material shall be obtained from borrow pits off site.

C. The Contractor shall pay for all soil analysis for borrow material.

1.05 EXCAVATED MATERIAL

A. All material to be excavated shall be classified as earth.

1.06 UNSUITABLE BEARING MATERIALS

A. Should unsuitable bearing materials be encountered at levels indicated and found to have insufficient bearing values the Engineer may order the excavation carried to lower depths.

B. Compensation for the removal and/or replacement of unsuitable materials shall be in accordance with the General Conditions, Article 10.01.

C. Excavation of unsuitable bearing materials shall not proceed until the conditions have been observed by the Engineer and written approval has been given by the Owner.

PART 2 – EXECUTION

2.01 TOPSOIL

- A. Areas to be stripped shall first be scraped clean of all brush, weeds, grass, roots, and other material.
- B. Remove topsoil from areas to be graded and stockpile in locations where it will not interfere with structures, roads, or utility operations.
- C. Topsoil shall be free from subsoil, debris, and stones larger than 2 inches in diameter. The stored topsoil shall be left in piles to be used for finished grading. Contractor shall install a minimum of 4 inch thick topsoil across pervious areas of the site prior to planting. If topsoil from site is unsuitable or insufficient to achieve 4 inch thickness, additional material is to be provided by the Contractor at no additional cost to owner and from a source approved by Engineer.
- D. Stockpiles shall be protected from contamination by undesirable foreign matter and shall be graded to shed water.

2.02 EXCAVATION

- A. Excavations shall be accomplished to bring surface to the levels, lines and grades as indicated.
- B. Excavated material to be used for fill or backfill material shall be stockpiled on the site as directed by the Engineer. Stockpiles shall be graded to shed water.

2.03 FILLING

- A. All fill material required to bring areas to the levels, lines and grades indicated shall be selected and approved materials from approved borrow areas.
- B. Sub-grades on which fill material is to be placed shall be scarified to a depth of not less than 4 inches by plowing or discing. A layer of suitable fill material, approximately 3 inches in depth, shall be spread over the scarified surface and compacted.
- C. Fill material shall be spread and compacted in successive uniform layers not exceeding 8 inches in depth (loose measure) until the total thickness of fill is completed.

2.04 COMPACTION

- A. Compaction required for material fill shall be 95% of Standard Proctor, maximum dry density as determined by the procedures of ASTM D-698. Fill areas shall be crowned and sloped to drainage ditches or as required to prevent ponding of surface water.
- B. Compaction by flooding of any material is not acceptable. In the event that any flooding takes place, the material and all adjacent softened material shall be removed and replaced with compacted fill at no cost to the Owner.

2.05 FINISH GRADE

- A. Distribute topsoil evenly to levels, lines and grades shown.
- B. Finish grade to be trimmed and raked true to line and grade to avoid surface ponding.
- C. Remove stone two inches or greater in diameter and debris from soil.
- D. Finish grade tolerance to +/- 0.05 foot for roadways and +/- 0.10 foot for other areas.

END OF SECTION

**SECTION 02221
TRENCH EXCAVATION, BACKFILL, AND COMPACTION**

PART 1 - GENERAL

1.01 SCOPE, STANDARDS & DEFINITIONS

- A. Work under this section shall consist of furnishing all materials, equipment and labor for excavation, trenching and backfilling for utility systems. "Utility systems" shall include underground piping and appurtenances for water distribution systems, storm water drains, sewage collection systems, force mains, spray irrigation system and all other pipes and appurtenances shown on the drawings.
- B. Applicable Standards and Reference
 - I. ASTM D2321 Soil Classification and Restrictions
 - a. Class IA = Manufactured crushed stone, shell, crushed slag or rock, open graded, clean, large voids, contains no fines, can allow sand migration to create excessive settling. Suitable as drainage blanket.
 - b. Class IB = Manufactured aggregate dense graded, clean, crushed stone with sand and gradation present. Closer void so little migration of sand, little fines. Minimal migration of sand. Suitable as drainage blanket.
 - c. Class II = Coarse grained soils and sand, graded gravel and sandy mix, minimal migration of silt or sand, Use as drainage blanket and drains limited.
 - d. Class III = Coarse grain sand with fines, silty gravel, gravel-sand-silt mixture, clayey gravels, silty sand mixture. Not to be used in the presence of water.
 - e. Class IVA = Fine grain soils, inorganic, Inorganic silts and very fine sand, silty clayey fine sands, inorganic clay with minor plasticity, lean clay. Use only where no water exists and shallow fills.
 - f. Class IVB = Fine Grained soils inorganic, micaceous fine sand, silty soil, fat clay, clay with high plasticity. Use requires geotechnical evaluation.
 - g. Class V = Organic soils, clay and silt with organics. No permitted use other than top 6" outside roadways for soil amendment for grassing.

1.02 EXISTING UTILITIES

- A. Before opening trenches, the Contractor shall examine all available records and explore for the location of all sub-surface pipes, valves or other structures and reference such locations on the surface.
- B. In opening trenches, every effort shall be made not to interfere with these utilities' structures. Expose existing piping by hand before excavating by machine. Excavate existing utilities sufficiently in advance of pipe laying to determine crossing arrangement. Slight deviations may be permitted in order to clear such structures.

The Contractor shall be entirely responsible for the preservation of all underground or overhead utility lines and structures, such as gas, water, sewer lines, telephone conduit, power lines, etc., and shall replace, adjust or repair, without additional compensation, any such lines damaged or interfered with as a result of this construction.

- C. Schedule work to keep roads and utilities in usable condition; coordinating all operation with the Owner to avoid inconvenience insofar as practicable.

1.03 EXCAVATED MATERIAL

- A. All material to be excavated shall be classified as earth.

1.04 BORROW MATERIAL

- A. Any borrow material required to accomplish all levels, lines and grades indicated shall be furnished by the Contractor at no expense to the Owner.
- B. Borrow material shall be obtained from borrow pits off site.
- C. The Contractor shall pay for all soils analysis for borrow material.

1.05 TESTING

- A. All soil testing shall be performed by an Independent Testing Laboratory selected by the Engineer and paid for by the Contractor.

1.06 QUALITY ASSURANCE

- A. All excavation within the rights of way of city streets and county, State or Federal roadways, shall be backfilled in accordance with the then prevailing requirements of the Georgia Department of Transportation, Highway Division.
- B. Reference Standards: Methods of Sampling and Testing of American Association of State Highway and Transportation Officials (AASHTO).

PART 2 - EXECUTION

2.01 GENERAL EXCAVATION

- A. The Contractor shall do all excavation of whatever substances encountered to depth shown on plans. Excavated materials not required for fill or backfill shall be removed from site as directed by the Engineer.
- B. Contractor is to excavate to provide 3-foot minimum cover over utility.
- C. Excavation for manholes and other accessories to have 12 inches minimum and 24-inch maximum clearance on all sides.
- D. Excavation shall not be carried below the required level.
- E. Where excavation is carried below grades indicated, the Contractor shall refill same to the proper grade with compacted earth or stone, or as directed by the Engineer.

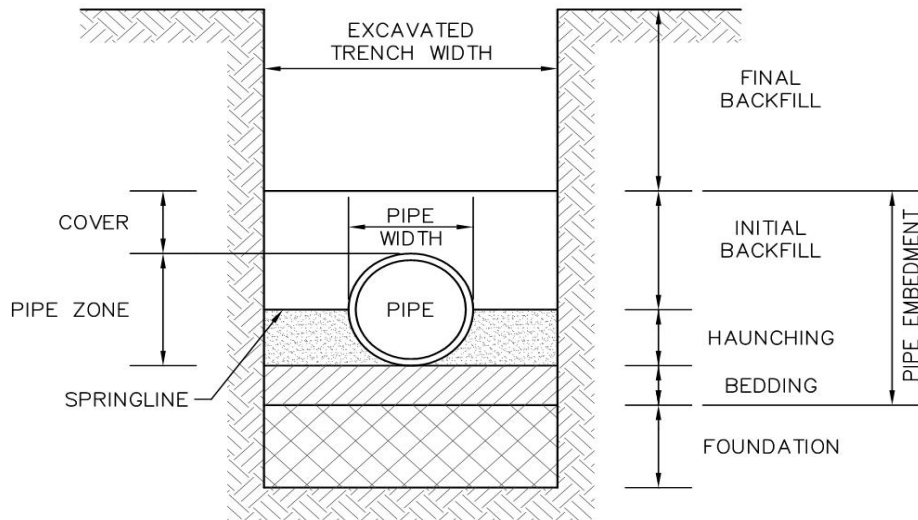
- F. Banks of trenches shall be vertical.
- G. Width of trench shall be as shown on the plans. The bottom of trench for sewers and culverts shall be rounded so that an arc of the circumference equal to 0.6 of the outside diameter of the pipe rests on undisturbed soil.
- H. Bell holes shall be excavated accurately to size by hand.

2.02 UNSUITABLE BEARING MATERIALS

- A. Should unsuitable bearing materials be encountered at levels indicated and found to have insufficient bearing values the Engineer may order the excavation carried to lower depth.
- B. Compensation for the removal and/or replacement of unsuitable bearing materials shall be in accordance ASTM D2321 requirements.
- C. Excavation of unsuitable bearing materials shall not proceed until the conditions have been observed by the Engineer and written approval is given by the Owner.

2.03 PIPE BEDDING

- A. The following detail provides trench & pipe zone terminology.



PIPE BEDDING DETAIL
N.T.S.

- B. The trench floor should be constructed to provide firm, stable, and uniform support for the full length of the pipe. This can be accomplished by bringing the entire trench floor level grade and then creating bell holes at each joint to permit proper joint assembly, alignment and support. Portions of the trench that are excavated below grade should be returned to grade and compacted as required to provide proper support. If native trench soil is not suitable for pipe bedding, the trench should be over excavated and refilled with suitable foundation material either local sandy material compacted to 90% Std. Proctor or #57 stone depending on the presence of water and, as approved by the engineer. Bedding material shall be Class IB or II as defined in ASTM D2321. Large rocks or hard material should not be contained in the bedding area (minimum of 6") below the pipe.
- C. The most important factor in assuring proper pipe-soil interaction is the haunching material and its density. This material provides the majority of the support that the pipe requires to function properly in regards to deflection and performance. The haunching material shall be placed and compacted under the pipe haunches as shown in the detail above. Proper control should be exercised to avoid deflecting the pipe from proper alignment. The same material that is used for bedding should be used for haunching and compacted to the same standards. Haunching material shall be Class IB or II as defined in ASTM D2321.
- D. Initial backfill, as shown in the detail above, shall be accomplished with suitable, compactable material and compacted in 6" layers. Material shall meet the requirements of Class Ib, II or III as restricted in ASTM D2321.
- E. Final Backfill will be accomplished by placing material in 12" lifts and compacting to a level determined by the final use of the area above the pipe. Final backfill in roadways shall require placement of suitable Class IA, IB, II and III backfill material, placed in 12" lifts and compacted to 100% standard proctor (ASTM Test D-698). Final Backfill outside of roadways shall be Class II, III or IVA and lightly compacted to avoid settling in the future. The top 6" of the final backfill, outside of roadways, shall be suitable for establishing a final grassed surface.
- F. Material used in the "trench & pipe zone" shall be restricted as per the limitations and restrictions as outlined in ASTM D2321

2.04 BRACING AND SHORING

- A. The Contractor shall do all bracing, sheeting and shoring necessary to perform and protect all excavations as required for safety.
- B. Sheeting driven alongside the pipe should be cut off and left in place to an elevation 1.5 feet above the top of the pipe.
- C. All other sheeting shall be removed as directed by the Engineer.

2.05 DEWATERING FOR EXCAVATION

- A. The Contractor shall pump or remove any water accumulated in any excavated area and shall perform all work necessary to keep excavations clear of water while foundations, structures or any masonry are being constructed or while pipe is being laid.

- B. No structure or pipe shall be laid in water, and water shall not be allowed to flow over or rise upon any concrete or masonry or piping until same has been inspected and the mortar or joint material has cured.
- C. No extra compensation will be allowed for removal of water.
- D. All water pumped or bailed from the trenches or other excavation shall be conveyed to a point of discharge where it will neither cause a hazard to the public health, nor damage to the public or private property, or to work completed or in progress.

2.06 BACKFILL

- A. The soil at the sides of a pipe and above it is the backfill.
- B. Prior to backfilling any excavation, all piping and structures shall be observed by the Engineer.
- C. After pipes have been tested and approved, backfilling shall be done with approved material free from large clods or stones.
- D. Backfill shall be placed in uniform layers, four inches thick, on both sides of the pipe and thoroughly compacted with pneumatic or hand tampers. The backfill shall be brought up uniformly on both sides of the pipe and compacted to an elevation of one foot above the top of the pipe, after which the fill shall be placed in eight inch lifts. No rock will be allowed in the backfill within a distance of one foot from the pipe, and rock larger than six inches in the greatest dimension will not be permitted in any part of the trench or backfill.
 - 1. Backfill shall be compacted to not less than 95% of the maximum dry weight per cubic foot as determined by AASHTO Method T-99 (Standard Proctor Test).
 - 2. The top 18 inches of backfill under any paved area shall be compacted to 100% Standard Proctor.
 - 3. Water settling will not be permitted in clay soils. It may be required at the option of the Engineer in sandy soils.

2.07 REPLACING PAVEMENTS

- A. Subgrades shall be compacted with a mechanical tamper.
- B. The minimum width of replaced concrete pavements shall be 4 feet at interiors and 6 feet at joints and constructed as shown on Standard Details. Avoid cutting pavements at joints; if unavoidable, reconstruct same as original joint. Depth shall be equal to the original thickness. Existing pavements edges shall be cut vertical.
- C. Use high-early-strength cement if road is to be opened in less than 3 days.
- D. The minimum width of replaced bituminous pavements shall be 3 feet with 8 inch concrete patch. The existing pavement shall be cut vertically and horizontally to a straight line. The 8 inch concrete patch shall be minimum 3,000 psi concrete containing black dye and shall be flush with the existing pavement.

END OF SECTION

**SECTION 02415
SITE DEMOLITION**

PART 1 - GENERAL

1.01 DESCRIPTION

This section specifies demolition and removal of buildings, portions of buildings, utilities, other structures, and debris from trash dumps shown.

1.02 RELATED WORK

- A. Demolition and removal of roads, walks, curbs, and on-grade slabs outside buildings to be demolished.
- B. Safety Requirements: GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- C. Disconnecting utility services prior to demolition: Section 01 00 00, GENERAL REQUIREMENTS.
- D. Reserved items that are to remain the property of the Owner.
- E. Asbestos Removal: See Hazardous Material Sections of General Conditions.
- F. Lead Paint: See Hazardous Material Sections of General Conditions.
- G. Environmental Protection: See Erosion and Sedimentation Control Specification.
- H. Construction Waste Management: See General Requirements Specification.

1.03 PROTECTION

- A. Perform demolition in such manner as to eliminate hazards to persons and property; to minimize interference with use of adjacent areas, utilities and structures or interruption of use of such utilities; and to provide free passage to and from such adjacent areas of structures. Comply with requirements of GENERAL CONDITIONS Article, ACCIDENT PREVENTION.
- B. Provide safeguards, including warning signs, barricades, temporary fences, warning lights, and other similar items that are required for protection of all personnel during demolition and removal operations.
- C. Maintain fences, barricades, lights, and other similar items around exposed excavations until such excavations have been completely filled.
- D. Provide enclosed dust chutes with control gates from each floor to carry debris to truck beds and govern flow of material into truck. Provide overhead bridges of tight board or prefabricated metal construction at dust chutes to protect persons and property from falling debris.
- E. Prevent spread of flying particles and dust. Sprinkle rubbish and debris with water to keep dust to a minimum. Do not use water if it results in hazardous or

objectionable condition such as, but not limited to, ice, flooding, or pollution. Vacuum and dust the work area daily.

- F. In addition to previously listed fire and safety rules to be observed in performance of work, include following:
 - 1. No wall or part of wall shall be permitted to fall outwardly from structures.
 - 2. Maintain at least one stairway in each structure in usable condition to highest remaining floor. Keep stairway free of obstructions and debris until that level of structure has been removed.
 - 3. Wherever a cutting torch or other equipment that might cause a fire is used, provide and maintain fire extinguishers nearby ready for immediate use. Instruct all possible users in use of fire extinguishers.
 - 4. Keep hydrants clear and accessible at all times. Prohibit debris from accumulating within a radius of 4500 mm (15 feet) of fire hydrants.
- G. Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The contractor shall take necessary precautions to avoid damages to existing items to remain in place, to be reused, or to remain the property of the Owner; any damaged items shall be repaired or replaced as approved by the Resident Engineer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal works. Repairs, reinforcement, or structural replacement must have Resident Engineer's approval.
- H. The work shall comply with the requirements of the Erosion and Sediment Control Specification and other sections of this specification.
- I. The work shall comply with the requirements of GENERAL REQUIREMENTS.

1.04 UTILITY SERVICES

- A. Demolish and remove outside utility service lines shown to be removed.
- B. Remove abandoned outside utility lines that would interfere with installation of new utility lines and new construction.

PART 2 - EXECUTION

2.01 DEMOLITION

- A. Completely demolish and remove buildings and structures, including all appurtenances related or connected thereto, as noted below:
 - 1. In accordance with Building Demolition Specification.

2. As required for installation of new utility service lines.
 3. To full depth within an area defined by hypothetical lines located 1500 mm (5 feet) outside building lines of new structures.
- B. Debris, including brick, concrete, stone, metals, and similar materials shall become property of Contractor and shall be disposed of by him daily, off the project site to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Resident Engineer. Break up concrete slabs below grade that do not require removal from present location into pieces not exceeding 600 mm (24 inches) square to permit drainage. Contractor shall dispose debris in compliance with applicable federal, state, or local permits, rules and/or regulations.
- C. Remove and legally dispose of all materials, other than earth to remain as part of project work, from any trash dumps shown. Materials removed shall become property of contractor and shall be disposed of in compliance with applicable federal, state, or local permits, rules and/or regulations to a permitted site. All materials in the indicated trash dump areas, including above surrounding grade and extending to a depth of 1500mm (5feet) below surrounding grade, shall be included as part of the lump sum compensation for the work of this section. Materials that are located beneath the surface of the surrounding ground more than 1500 mm (5 feet), or materials that are discovered to be hazardous, shall be handled as unforeseen. The removal of hazardous material shall be referred to Hazardous Materials specifications.
- D. Remove existing utilities as indicated or uncovered by work and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Resident Engineer. When Utility lines are encountered that are not indicated on the drawings, the Resident Engineer shall be notified prior to further work in that area.

2.02 CLEAN-UP

On completion of work of this section and after removal of all debris, leave site in clean condition satisfactory to Resident Engineer. Clean-up shall include off the offsite disposal of all items and materials not required to remain property of the Owner as well as all debris and rubbish resulting from demolition operations.

END OF SECTION

**SECTION 02520
STORM DRAINAGE AND APPURTENANCES**

PART 1 - GENERAL

1.01 APPLICABLE STANDARDS

- A. Appurtenances shall be constructed in accordance with the referenced Georgia Department of Transportation Standard Drawings.
- B. American Society for Testing and Materials (ASTM):
 - C- 32 Specification for Sewer and Manhole Brick.
 - C- 76 Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.
 - C-144 Aggregate for Masonry Mortar.
 - C-270 Mortar for Unit Masonry
 - C-443 Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
 - C-913 Specification for Precast Concrete Water and Wastewater Structures
 - C-536 Test for Continuity of Coatings in Glassed Steel Equipment by Electrical Testing.
- C. Only reinforced concrete pipe will be allowed under roadways or frequently traveled areas.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Roadway Storm Drainage Pipe: Pipe shall be reinforced Concrete Pipe which conforms to ASTM Specification C-76 and shall be of sizes shown. Pipe shall be Class III minimum and as indicated on GA. D.O.T. Standard 1030 D.
- B. Non-Roadway Storm Drainage Pipe: Pipe shall be one of the following:
 - 1. Corrugated metal pipe shall conform to AASHTO designation M-36, AREA Manual 1-4 requirements for corrugated metal culverts, or Federal Specification QQ-C- 806, with the following applicable requirements:
 - a. The outside and inside surfaces of the corrugated metal pipe shall be completely coated with bituminous material with a minimum thickness of 0.05 inch at the crest of the corrugations. Immediately prior to the application of the bituminous coating, the corrugated metal pipe shall be cleaned of all dirt, grease, mill scale, or loose rust and shall be dry.

- b. The outside and inside surfaces of the corrugated metal pipe shall be completely coated with a pure aluminum coating metallurgically bonded by an alloy layer between the steel and the aluminum. The coating shall be applied at a minimum of 1 oz./sq.ft., 2 mils. each side. The weight of aluminum (total both sides) shall be as follows: Minimum check limit triple-spot test=1.00 oz/sq feet, minimum check limit single-spot test=0.90 oz/sq feet. The aluminized steel pipe shall be Armco Aluminized Steel Type 2 or equal.
 - c. All rivets shall be placed in the inside valley of the corrugations. The interior coating shall be protected against damage from insertion or removal of struts or tie wires. Lifting lugs, where used, shall be so placed as to facilitate moving the pipe without damage to the exterior or interior coating. All lateral pipe shall be sixteen (16) gauge. All pipe under possible traffic areas will be twelve (12) or fourteen (14) gauge as indicated.
 - d. To facilitate field jointing, the ends of pipes with helical corrugations shall be rerolled to form circumferential corrugations from the end. The diameter of the reformed ends shall not exceed that of the pipe barrel by more than the depth of the corrugation.
2. Polyvinyl chloride (PVC) pipe shall be manufactured and tested in accordance with specification for "Poly (Vinyl Chloride) PVC Large Diameter Ribbed Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter." The pipe and fittings shall be made of PVC plastic and shall have a smooth (not ribbed or corrugated) inside surface.
- a. All pipe shall be bell and spigot. The bell shall consist of an integral wall section or an internal plastic sleeve. The solid cross section rubber ring shall be factory assembled on the spigot. Size and dimensions shall be as shown on the plans. Standard laying length shall be 13 feet \pm 1 inch.
 - b. All fittings and accessories shall be as manufactured and furnished by the pipe supplier or approved equal and have bell and/or spigot configurations compatible with that of the pipe.
 - c. Pipes shall be designed to pass all tests described herein at 73° F (\pm 3° F).
 - d. The pipe stiffness shall equal or exceed 10 psi when tested in accordance with ASTM D 2412.
3. High density Polyethylene (HDPE) pipe shall be manufactured for use in nonpressure storm sewer. The pipe shall be manufactured to meet AASHTO M294, Type 'S' for 12" through 36" and AASHTO MP6-96, Type 'S' OR 'D' for 42" and 48" pipe. The pipe and fittings shall be made from HDPE material and shall have a smooth (not ribbed or corrugated) inside surface.
- a. All pipe shall be bell and spigot. The bell shall be an integral part of the pipe. The joint shall use a gasket to form a water tight connection meeting ASTM D3212. Gaskets shall be installed in the bell or in the spigot by the manufacturer. The use of Silt tight fittings may be requested in lieu of water tight connection if approved by the engineer.

- b. All fittings shall conform to AASHTO M294 or MP6-95. Fabricated fittings shall be welded on the interior and exterior at all junctions.
- c. Pipe and fittings material shall be high-density polyethylene meeting ASTM D3350.
- d. Installation shall be in accordance with ASTM D2321.
- e. Pipe may be Advanced Drainage System, Inc., N-12 or N-12 HC or Hancor Sure Lok 10-8 pipe.
- f. HDPE end sections are NOT allowed.

C. Pipe Joints:

- 1. Joints for concrete pipe shall be one of the following types:
 - a. Bell and spigot with rubber gaskets.
 - b. Tongue and groove with rubber gaskets.
 - c. Tongue and groove with preformed plastic gaskets.
- 2. Rubber Gaskets shall conform to ASTM Specification C443. Only a neutral agent shall be used as a lubricant. Preformed Plastic Gaskets shall conform to Federal Specification SS-S210, Type I-rope form.
- 3. Field joints of corrugated steel pipe shall maintain pipe alignment during construction and prevent infiltration of side material during the life of the installation. Circumferential and longitudinal strength shall be provided in accordance with the structural joint performance criteria of Division 2, Section 23 of the AASHTO standard specification for Highway Bridges. The bands shall be constructed in such a manner that will effectively engage the pipe ends. Coupling bands shall not be more than 3 nominal sheet thicknesses lighter than the thickness of the pipe to be connected and in no case lighter than 0.052 inches. Bolts and nuts for coupling bands shall conform to the requirements of ASTM Designation: A307.

Bands shall be furnished to lock with the circumferential corrugations, including rerolled end helical pipe. The corrugated bands shall be not less than 7 inches wide for diameter 4 to 36 inches, inclusive, and not less than 10 1/2 inches wide for all other pipe diameters.

NO DIMPLE BANDS WILL BE ALLOWED.

- 4. Joints for PVC pipe must be an integral bell gasketed joint which forms a silt tight joint.

D. Precast Concrete Manhole Sections:

ASTM C913, except that spacing of manhole steps or ladder rungs shall not exceed 12 inches.

- E. Masonry Manholes: Shall be constructed of the following materials:
 - 1. Brick: ASTM C32, Grade MS
 - 2. Mortar of Masonry: ASTM C279, Type M.
 - 3. Aggregate for Masonry Mortar: ASTM C144.
 - 4. Water for Masonry Mortar shall be fresh, clean, and potable.

- F. METALS
 - 1. Frames, Covers, and Grating: Frames, covers, and grating shall conform to AASHTO M-306-07 and shall be of grey iron castings.
 - 2. Manhole Steps: Manhole steps shall be constructed of a number of 3 reinforcing bar encapsulated in polypropylene plastic with a non-skid tread. Finished dimensions of the steps shall be identical to that of malleable iron manhole steps. Steps to have a minimum tread width of 12 inches.

2.02 DELIVERY AND STORAGE

- A. Storm Drainage Pipe: Care shall be exercised in loading and unloading pipe, fittings, specials and castings at all times in order to avoid shock and damage to the materials. Lifting shall be by hoist or by rolling on skids. Dropping will not be permitted. The Contractor shall be responsible for the safe handling of all materials and no damaged materials shall be used in the work. Materials shall be inspected upon arrival at the site, and any damaged or defective materials shall be immediately removed from the site. All materials shall be stored above grade.

- B. Cementitious Materials: Cementitious materials in bags shall be stored in enclosed structures; floors shall be elevated above the ground a distance sufficient to prevent the absorption of moisture.

- C. Metal Items: Metal items, including reinforcing steel, shall be stored above grade in a manner which will not cause excessive rusting or coating with grease or other objectionable materials.

- D. PVC Pipe: PVC pipe shall be stored protected from sun light by means of covering the pipe or storing inside a building or under a covered shed. Any pipe showing signs of prolonged outside storage (i.e., faded exterior color or signs of drying) shall be rejected.

- E. Aggregates: Aggregates shall be stored on areas to prevent the inclusion of foreign material. Aggregates of different sizes shall be stored in separate piles. Stockpiles of coarse aggregate shall be built in horizontal layers not exceeding 4 feet in depth to minimize segregation. Should the coarse aggregate become segregated, it shall be remixed to conform to the grading requirements.

- F. Brick, Concrete Masonry Units and Precast Concrete Manholes: Brick, concrete masonry units and precast concrete manholes shall be handled with care to avoid chipping and breakage, and shall be stored to protect them from contact with the

earth and exposure to the weather, and shall be kept dry until used. Masonry units or precast concrete containing frost or ice shall not be used.

PART 3 - EXECUTION

3.01 DRAINAGE PIPE

- A. Each section of pipe shall be carefully examined before being laid, and defective or damaged pipe shall not be used.
- B. Under no circumstances shall pipe be laid in water, and no pipe shall be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. Pipe shall be laid true to line and grades indicated and shall rest upon the pipe bed for the full length of each section. Runs of pipe shall be laid with outside bells or grooved ends up-grade beginning at the lower end of the pipe line. Pipe having its grade and/or joint disturbed after laying shall be removed, cleaned, and relayed.
- C. When pipes are protected by head walls or connect with drainage structures, the exposed ends of the pipe shall be placed or cut flush with the inside face of the structure. After the pipe is cut the rough edges shall be smoothed up in an approved manner. All pipe shall be laid so that markings are on top and the inner surfaces abut neatly, tightly and smoothly.
- D. All pipe in place shall be observed by the Engineer before being covered and concealed unless this requirement is waived by the City Inspector and the Design Engineer. Contractor shall clear all pipe of silt debris prior to final acceptance.

3.02 CORRUGATED METAL PIPE JOINTS

- A. Corrugated metal pipe shall be butted to form a smooth joint; the space between the pipe and coupling bands shall be kept free from dirt and grit so that the corrugations fit snugly. The coupling band while being tightened shall be tapped with a soft head mallet of wood, rubber or plastic to take up slack and insure a tight joint. Coupling band bolts and damaged areas of the coupling bands and pipe shall be given a coating of bituminous cement. Pipe on which the asphalt coating has been damaged to such extent that satisfactory field repairs cannot be made will be replaced.

3.03 CONCRETE PIPE JOINT

- A. Joint installation shall be in accordance with the recommendations of the manufacturer of the joint material. Surfaces to receive lubricants, cements or adhesives shall be clean and dry. Gaskets and jointing materials shall be affixed to the pipe not more than 24 hours prior to the installation of the pipe, and shall be protected from the sun, blowing dust and other deleterious agents at all times. Gaskets and jointing materials shall be inspected before installation of the pipe, and any loose or improperly affixed gaskets and jointing materials shall be removed and replaced.
- B. The pipe shall be aligned with the previously installed pipe, and the joint pulled together. If, while making the joint, the gasket or jointing material becomes loose

and can be seen through the exterior joint recess when the joint is pulled up to within one inch of closure, the pipe shall be removed and the joint remade.

3.04 MASONRY WORK

- A. Mortar for Masonry: Mortar for brick masonry, rubble stone masonry, and for bedding cast iron frames in masonry shall be Type M, conforming to ASTM C270.
- B. Mortar for pargetting Masonry Walls: Mortar for pargetting masonry walls below grade shall be Type M, conforming to ASTM C270.
- C. Brickwork: Brick in circular walls shall be laid in all header courses to form full and close mortar joints, ends and sides in one operation. Vertical joints shall be radial from the center. Brickwork around pipe inlets and outlets shall not be allowed. Gaps shall be poured with concrete.
- D. Masonry Structures: Masonry structure walls shall be constructed of brick, concrete masonry units or precast concrete structural sections.

3.05 PRECAST CONCRETE

- A. Walls shall be constructed on a footing of cast-in-place concrete, except that precast concrete base sections may be used for precast concrete structure risers. Precast base sections shall conform to the applicable requirements for precast risers and tops in ASTM C913. Mortar that has hardened to the extent that it cannot be made workable without the addition of water shall not be used. Thickness of parget shall be not less than 1/2 inch. No pargetting will be permitted on the inside of structures. Pargetting will not be required for precast concrete structures. Joint work inside masonry structures shall be smooth.
- B. One course of brick work is allowed for leveling and adjustment. All other adjustments must be poured in place concrete with a maximum height of 24 inches.
- C. For single and double wing catch basins a concrete pad shall be poured 4 inches thick with a minimum slope of 1" per foot away from the curb and gutter and towards the box.

3.06 METAL WORK

- A. Iron and steel shall be formed to shape and size with sharp lines and angles. Shearing and punching shall produce clean true lines and surfaces. Casting shall be sound and free from warp, cold shuts, and blow holes that may impair their strength or appearance. Exposed surfaces shall have a smooth finish and sharp well-defined lines and arises. The necessary rivets, lugs, and brackets shall be provided.

3.07 FIELD TEST

- A. A light held in a drainage structure shall show a practically full circle of light through the pipe when viewed from the adjoining end of the line.
- B. Lines under pavements shall be tested for infiltration by means of a suitable weir or other measurement device as directed by the Owner. When determination of infiltration is not practicable because of dry trench conditions, an exfiltration test shall

be applied by filling with water so that the hydraulic head will be at least 6 inches above the crown of the upper end and of the section being tested. The amount of leakage (infiltration or exfiltration) shall not exceed 100 gallons per inch of diameter per day per mile of pipe.

END OF SECTION

**SECTION 02540
EROSION CONTROL**

PART 1 - GENERAL

1.01 The work specified in this Section consists of furnishing, installing and maintaining temporary erosion controls and temporary sedimentation controls.

1.02 DEFINITIONS

- A. Temporary erosion controls shall include grassing, mulching, watering and reseeding on-site sloped surfaces, providing berms at the top of the slopes and providing interceptor ditches at the ends of berms and at those locations which will ensure that erosion during construction will be either eliminated or minimized.
- B. Temporary sedimentation controls shall include silt dams, traps, barriers and appurtenances at the toe slopes.

PART 2 - MATERIALS

2.01 Hay bales shall be clean, seed free cereal hay type, securely bound.

2.02 Netting shall be 1/2-inch, galvanized steel chicken wire mesh.

2.03 Filter stone shall be crushed stone conforming to the Department of Transportation - State of Georgia-Standard Specifications – Construction of Transportation Systems - 2013 - Table 800.01, Size Number 3.

2.04 Rolled Erosion Control Products:

- A. Mulch Control Netting. A planar woven natural fiber or extruded geosynthetic mesh used as a temporary degradable rolled erosion product anchor loose fiber mulches
Max. Gradient = 5:1 (H:V) in slope application
C Factor = ≤ 0.10 @ 5:1 in slope application
Max Shear stress 0.25 lb/sf in channel application
Min. Tensile Strength ultra-short (3 mo) and short (12 mo) term = 5 lbs/ft
Min Tensile Strength extended term ((24 mo) = 25 lbs/ft
- B. Open Weave textile. A temporary degradable rolled erosion control product composed of processed natural or polymer yarns woven into a matrix, used to provide erosion control and facilitate vegetation establishment.
Max. Gradient = 3:1 (H:V) in slope application
C Factor = ≤ 0.15 @ 3:1 in slope application
Max Shear stress = 1.5 lb/sf in channel application
Min. Tensile Strength ultra-short (3 mo) and short (12 mo) term = 50 lbs/ft
Min Tensile Strength extended term ((24 mo) = 100lbs/ft
- C. Erosion Control Blanket. A temporary degradable rolled erosion control product composed of processed natural or polymer fibers mechanically, structurally, or chemically bound together to form a continuous matrix to provide erosion control and facilitate vegetation establishment.

Netless Rolled Erosion Control Blankets:

Max. Gradient = 4:1 (H:V) in slope application

C Factor = ≤ 0.10 @ 4:1 in slope application

Max Shear stress = 0.5 lb/sf in channel application

Min. Tensile Strength ultra-short (3 mo) and short (12 mo) term = 5 lbs/ft

Single-net Erosion Control Blankets:

Max. Gradient = 3:1 (H:V) in slope application

C Factor = ≤ 0.15 @ 3:1 in slope application

Max Shear stress = 1.5 lb/sf in channel application

Min. Tensile Strength ultra-short (3 mo) and short (12 mo) term = 50 lbs/ft

Min Tensile Strength extended term ((24 mo) = 100lbs/ft

Double-net Erosion Control Blankets:

Max. Gradient = 2:1 (H:V) in slope application

C Factor = ≤ 0.2 @ 2:1 in slope application

Max Shear stress = 1.75 lb/sf in channel application

Min. Tensile Strength ultra-short (3 mo) and short (12 mo) term = 75 lbs/ft

- D. Turf Reinforcement Mat. A rolled erosion control product composed of non-degradable synthetic fibers, filaments, nets, wire mesh, and/or other elements, processed into a permanent, three-dimensional matrix of sufficient thickness. TRMs, which may be supplemented with degradable components, are designed to impart immediate erosion protection, enhance vegetation establishment, and provide long term functionality by permanently reinforcing vegetation during and after maturation. These products are typically used in hydraulic applications such as high flow ditches, channels, steep slopes, stream banks, and shorelines, where erosive forces may exceed the limits of natural, unreinforced vegetation.
- Slope Application max gradient = 0.5:1 (H:V)
Channel Application Max Shear Stress: 5A, B,C as defined in FHWA guidelines
5A = 6.0 lb/sf, 5B = 8.0 lb/sf, 5C = 10.0 lbs/sf
Min. Tensile Strength: 5A, B,C as defined in FHWA guidelines
5A = 125.0 lb/ft, 5B = 150.0 lb/ft, 5C = 175.0 lbs/ft
5A, B,C as defined in FHWA guidelines

PART 3 - EXECUTION

3.01 SEDIMENTATION CONTROL

- A. Silt dams, traps, barriers, and appurtenances shall be installed and shall be maintained in-place for duration of construction.
- B. Hay bales shall be staked with two (2) 1 x 4 wood stakes per bale driven eighteen (18) inches into the ground and finishing flush with the top of the bale.
1. Install two (2) stakes per bale with the long dimension of the stakes parallel to the long dimension of the bale.
 2. Where bales are installed in multiple layers the bales shall be installed with vertical joints staggered and two (2) 1 x 4 wood stakes per bale driven through all layers, full from top of bale to eighteen inches into the ground.
- C. Hay bales which have deteriorated shall be replaced with new materials.

- D. Erosion and sedimentation controls shall be maintained in a condition which will retain unfiltered water.
- E. The Contractor shall construct the sedimentation ponds and control devices prior to clearing and grubbing the site to insure complete silt control. When the silt or the debris level is greater than 1 foot above the bottom of the pond, the Contractor shall remove the silt or debris to restore the proper elevation for the bottom of the pond.
- F. The Contractor shall have all erosion and sedimentation control devices in service and operating properly prior to completion and final acceptance of the contract.
- G. Two widths of silt fence are available, Type A or C (36" height) and Type B (22" height). In order to determine which to use, the project duration, slope gradient, and slope length must be known (See Table 6-13.1 below). Approved silt fence fabrics are listed in the Georgia Department of Transportation list #36. The manufacturer shall have either an approved color mark yarn in the fabric or label the fabricated silt fence with both the manufacturer and fabric name every 100 feet.

TABLE 6-13.1

Land Slope	Maximum Slope Length Behind Fence
<u>Percent</u>	<u>feet</u>
<2	100
2 to 5	75
5 to 10	50
10 to 20	25
>20	15

All silt fence must meet the minimum standards set forth in Section 171- temporary Silt Fence, of the Department of Transportation, State of Georgia, Standard specification, current edition. See Table 6-13.5 for current Georgia DOT silt fence specifications.

3.02 EROSION CONTROL BALNKET INSTALLATION

- A. Prepare a stable and firm soil surface free of rocks and debris. Apply soil amendments as necessary to prepare seedbed. Place fertilizer, water, seed in accordance with manufacture and specification recommendations. Unroll parallel to the primary direction of flow. Ensure that the product maintains intimate contact with the soil over the entire installation. Do not stretch or allow material to bridge over the surface. Staple/stake blanket to soil such that each staple/stake is flush with the underlying soil. Install anchor trenches, seams and terminal ends as specified.
- B. The Upslope Trench, Seams and Terminal Ends may be secure by anchor trench, checks, slots, or staples as outlined in Erosion Control technology Council (ECTC) standards for upslope security.

- C. Staple installation shall be at a rate of 1.7 staples per square yard minimum. Sandy or silty soils may require more. Wet installations may require a more density securing.
- D. If seaming method is used seams shall overlap at least 4" and staples must be placed at sufficient spacing to avoid separation.
- E. Staples must be placed at 4"x 4" spacing on check slots and check seams.
- F. Consecutive rolls shall have overlaps of at least 6" and secured with staples every 1 foot.

3.03 RESPONSIBILITY

- A. The Contractor shall be solely responsible for ensuring that no silt or debris leaves the immediate construction site. Any silt or debris that does leave the immediate site shall be cleaned up and the area disturbed shall be returned to its natural state as directed by the Engineer at the Contractor's expense.
- B. The Contractor has the option to submit additional control measures in the form of shop drawings.

END OF SECTION

**SECTION 02554
NATURAL GAS DISTRIBUTION**

PART 1 - GENERAL

1.01 REFERENCE STANDARDS

ASTM A 53	Standard Specification for pipe, steel, black or hot dipped, zinc coated, welded and seamless
ASTM D 2513	Standard specification for Polyethylene (PE) as pressure pipe, tubing, and fittings
CSA/AM CSA/ANSI Z21.18	Gas appliance pressure regulators- 3 rd Edition
CSA/AM CSA/ANSI Z21.21	Automatic valves for gas appliance- 2 nd Edition
CSA/AM CSA/ANSI Z21.15	Manually operated gas valves for appliances, appliance connectors, valves, and hose end valves- 2 nd Edition
NFPA 54	National Fuel Gas Code – eff. 9-5-08
UFGS 26 42 14.00 10	Cathodic protection system (sacrificial anode)
UFGS 26 42 17.00 10	Cathodic protection system (impressed current)
UFGS 33 51 15	Natural gas/ liquefied petroleum gas distribution

1.02 DESCRIPTION

- A. All valves of the same type shall be from a single manufacturer. Parts for valves of the same type and size shall be interchangeable. Spare parts shall be furnished where required in the payment items.
- B. All valves shall open left (counter-clockwise).

1.03 SUBMITTALS

- A. Six copies of manufacturer's drawings and catalog cuts of the following items shall be submitted for approval of the Design Engineer:
 - 1. Pipe
 - 2. Fittings
 - 3. Joints and Couplings
 - 4. Hydrants
 - 5. Valves

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Materials delivered to site shall be inspected for damage, unloaded, and stored with the minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and rubber gaskets under cover and protect from exposure to direct sunlight. Store materials above ground. Interior of pipe and fittings shall be kept free of dirt and debris.

- B. Pipe, fittings, valves and other accessories shall be handled to insure delivery to the point of installation in sound undamaged condition. If coatings or linings of pipe or fittings are damaged, such pipe or fittings shall be removed from the site and new materials furnished. Pipe shall not be dragged. Rubber gaskets that are not installed immediately shall not be left in the sunlight but shall be stored under cover and protected from exposure to direct sunlight.

PART 2 - PRODUCTS

2.01 MEDIUM DENSITY POLYETHYLENE PIPE AND FITTINGS (MDPE)

- A. Materials used for the manufacture of polyethylene pipe and fittings shall be PE 2406 medium density polyethylene meeting cell classification 234363E per STM D 3350; and shall be Listed in PPI (Plastics Pipe Institute) TR-4 with standard grade HDB ratings of 1250 psi at 73°F, and 1000 psi at 140°F. All pipe and fittings materials shall be opaque yellow in color. Materials shall be stabilized against ultraviolet deterioration and shall be suitable for unprotected outdoor storage for at least four (4) years. Pipe dimensions shall be as follows:

Nominal Size	Average OD (in)	SDR	Min. Wall (in)	Weight (lb/ft)
½" IPS	0.840	9.3	0.090	0.0913
¾" IPS	1.050	11	0.095	0.1229
1" IPS	1.315	11	0.119	0.1943
1 ¼" IPS	1.660	11	0.151	0.3087
1 ½" IPS	1.90	11	0.173	0.4047
2" IPS	2.375	11	0.216	0.6317
3" IPS	3.50	11	0.318	1.3707
4" IPS	4.50	11	0.409	2.266
6" IPS	6.625	11	0.602	4.918
8" IPS	8.625	11.5	0.750	8.00

- B. Pipe shall be DriscoPlex™ 6500 PE 2406 polyethylene pipe, or equal and shall be manufactured and tested in accordance with the latest published edition of ASTM D 2513.
- C. Pipe shall be resistant to slow crack growth (SCG).

2.02 STEEL PIPE

- A. Steel pipe shall be schedule 40 black steel pipe meeting ASTM A53/A53M.
- B. All pipe shall conform to those requirements of 49 CFR 192 as well as API 5L.
- C. Plain ends for pipe 2" and smaller are allowed.
- D. Pipes larger than 2" shall be beveled for welding. Angle for welding is 30° with a root face of 1/16th inch.

E. All pipe shall be as described in the following table:

Nominal Size	Average OD (in)	ID (in)	Min. Wall (in)	Weight (lb/ft)
½"	0.840	0.622	0.109	0.85
¾"	1.050	0.824	0.113	1.13
1"	1.315	1.049	0.133	1.68
1 ½"	1.90	1.610	0.145	2.72
2"	2.375	2.067	0.154	3.65
3"	3.50	3.188	0.156	5.57
4"	4.50	4.188	0.188	8.66
6"	6.625	6.249	0.188	12.92
8"	8.625	8.071	0.277	24.69

- F. All steel pipe shall be wrapped half-lapped 10 mil polyethylene tape, double wrapped or AWWA C105 polyethylene jacket.
- G. All joints shall have the same pressure rating as the pipe with which it is used.
- H. Pipe less than 3" shall be supplied in minimum 20' lengths. Pipe 3" and larger shall be 40' lengths.

2.03 FITTINGS AND SADDLES

- A. Fittings shall carry the same pressure rating and meet then same applicable ASTMs as the pipe. Polyethylene heat fusion fittings shall be manufactured and tested by the pipe manufacturer in accordance with ASTM D 2513 and D.O.T. requirements.
- B. Compression fittings shall be used only if approved by the owner of the gas system. Compression fittings shall be specifically manufactured to mechanically join plastic pipe and may be used as transition fittings in direct burial applications where the pipe is not joined by heat fusion. An internal metallic tubular stiffener that matches the internal diameter of the pipe shall be used at each compression fitting connection. Compression fittings shall not be used above ground.
- C. Screw fittings shall be used above ground only and shall be black malleable iron, standard weight of the band type, Screw fittings shall comply with the requirements of the ANSI B16.3 – American National Standard for Malleable-Iron Screwed Fittings and ANSI B2.1 – American National Standard for Pipe threads. Bushings, all thread nipples and cast-iron fittings are not permitted in the service line. Unions are not allowed in the service line except where they may be used for meter or regulator connections above ground.
- D. Approved plastic pipefittings and stab fittings may be used to connect lengths of plastic pipe. Plastic pipefittings shall conform to ASTM D2513 and ASTM D 2683 and shall be installed in accordance with manufacturers specifications.
- E. Saddles and Fittings shall be by the same manufacturer as the pipe.

2.04 RISERS

- A. Outside Meter settings - An approved flexible steel casing or rigid corrosive (anodeless) steel encased plastic service line riser, shall be installed with an outside meter setting installations utilizing nominal pipe size of 2" or smaller. A wall mount plate or bracket fastener to the riser and building wall shall be used to firm the installation. If attachment to the building wall is not practical, a heavy gage steel stake firmly embedded parallel and immediately adjacent to the foundation wall shall be used for support.
- B. Riser in Concrete or Asphalt – Where a riser passes through a sidewalk or other pavement, it shall be installed through a sleeve or other means of providing a space between the riser and the pavement. The 2" minimum space between the sleeve and the riser shall be filled with sand.

2.05 METER VALVES

- A. Meter valves must be approved by the gas company. Valves $\frac{3}{4}$ " to 1 $\frac{1}{4}$ " shall be the insulating union type having lock wing head or other tamper proof core. Each meter valve shall be provided with a drilled and tapped $\frac{1}{8}$ " port on the inlet side of the valve body for test purposes. An Allen head plug shall be used to close the port.
- B. Where the inlet piping to a single meter set assembly is 2" nominal pipe size, an insulating union, flange, or coupling shall be installed in the setting above ground and downstream of the meter valve to electrically isolate the service line from the house line. In addition, a test tee shall be installed above ground upstream of the meter.
- C. On service lines designed to operate at pressures of 100 psi or less, the meter shall have a manufacturer rated working pressure of not less than 125 psi. On service lines designed to operate in excess of 100 psi, the manufacturer's rated working pressure of the meter valve shall be 1.5 times the maximum operating pressure of the service line.

PART 3 – EXECUTION

3.01 GENERAL

- A. All valves shall be carefully mounted in their respective positions free from distortion and strain. All valves shall be properly packed and left in satisfactory operating condition at the completion of the project.
- B. Valve box, cover and concrete pad shall be installed with each valve as shown in miscellaneous details.
- C. Butt fusion shall be performed between pipe ends, or pipe ends and fitting outlets that have the same outside diameter and are not different in wall thickness by more than one Standard DR, for example, SDR 9 to SDR 11, or SDR 11 to SDR 13.5. Transitions between unlike wall thickness greater than one SDR shall be made with a transition nipple (a short length of the heavier wall pipe with one end machined to the lighter wall) or by mechanical means or electrofusion. Standard DRs for polyethylene pipe are 7.3, 9, 11, 13.5, 17 and 21.

- D. Polyethylene gas pipe and fittings may be joined together or to other materials by transition fittings, fully restrained mechanical couplings, or electrofusion. These devices shall be designed for joining polyethylene to another material and shall be approved by the Operator for use in his gas distribution system. When joining by other means, the installation instructions of the joining device manufacturer shall be observed.
- E. Butt, socket, and saddle fusion joints in polyethylene gas piping shall be made using procedures that have been qualified and approved by the Operator in accordance with Title 49, CFR, Part 192.283. In accordance with C.F.R. 49, part 192, Section 192.285, the Operator shall ensure that all persons making heat fusion joints have been qualified to make joints in accordance with the Operator's Approved Qualified Fusion Procedures. The Operator shall maintain records of qualified personnel and shall certify that qualification training was received not more than 12 months before commencing construction. The Contractor shall ensure that all persons making heat fusion joints are qualified in accordance with this section.
- F. The same Manufacturer shall supply polyethylene pipe and heat fusion fittings. Pipe and fittings from different Manufacturers shall not be interchanged.
- G. The squeeze-off technique can be useful for making installation tie-ins as well as for emergency repairs. Squeeze-off is not suitable for repeated flow control at the same location or to throttle or partially restrict flow. Valves or other flow control devices are more suitable for those situations. .ASTM standards provide guidance and requirements for squeeze-off tools, operating procedures, and qualification procedures.
- ASTM F1041, "Standard guide for Squeeze-Off of Polyolefin Gas Pressure Pipe and Tubing"
 - ASTM F1563, "Standard Specification for Tools to Squeeze-Off Polyethylene (PE) Gas Pipe or Tubing"
 - ASTM F1734, "Standard Practice for Qualification of a Combination of Squeeze Tool, Pipe, and Squeeze-Off Procedures to Avoid Long-Term Damage in Polyethylene (PE) Gas Pipe"
- H. In accordance with ASTM D 2774, connections shall be protected where an underground polyethylene branch or service pipe is joined to a branch fitting such as a service saddle, branch saddle or tapping tee on a main pipe, and where pipes enter or exit casings or walls. The area surrounding the connection shall be embedded in properly placed, compacted backfill, preferably in combination with a protective sleeve or other mechanical structural support to protect the polyethylene pipe against shear and bending loads.
- I. When installing the pipe through the casing utilizing the pull method the pipe will be protected from abrasion along the steel casing and at the entry and exit points. During the pulling operation the Allowable tensile Load (ATL) of the pipe shall not be exceeded. A pulling head shall be used for pulling pipe through the casing.
- J. High static electric charges can develop on polyethylene piping products, especially during squeeze-off, when repairing a leak, purging, making a connection, etc.

Where a flammable gas atmosphere and static electric charges may be present, observe all Company (pipeline operator, utility contractor, etc.) safety procedures for controlling and discharging static electricity and all requirements for personal protection.

3.02 PIPE AND FITTING INSTALLATION

- A. Polyethylene gas distribution piping shall be installed in accordance with C.F.R. 49, Part 192, Subpart G (mains), Subpart H (service lines), applicable codes and regulations and ASTM D 2774.
- B. Plastic pipe shall not be pushed or pulled over sharp objects, dropped or have other objects dropped on it.
- C. Injurious gouges or grooves and any kinks or buckles shall be removed by cutting out the damaged area.
- D. The pipe shall be installed in such a manner not to exceed the allowable radius of the pipe.
- E. The Contractor shall keep exposed ends of pipe properly plugged during laying to prevent dirt and other materials from entering the line, and shall also, before the system is accepted, thoroughly clean all lines.
- F. Plastic pipe shall be installed with sufficient slack to allow possible thermal contraction.
- G. The installation will be in accordance with Specification Section 02221 – Trench, Excavation and Backfill.
- H. All gas distribution mains shall have a minimum 30" of cover.
- I. Pipe runs should be continuous pipe except where pipe rolls end. All pipe in the main line will be heat fused connections in accordance with the manufacturer's recommendations.
- J. The Contractor shall install a continuous run of 14-gauge copper tracer wire with underground coating above the top of the MDPE pipe 12 inches above the pipe but no deeper than 48 inches below finished grade. The tracer wire shall be suitable for detection with metal pipe location equipment.
- K. Warning tape shall be installed along the entire run of pipe installed at 18" below grade.
- L. Changes in direction of plastic pipe shall be made with bends or elbows where the plastic pipe exceeds the allowable radius as per the manufacturer. Changes in direction shall be free of buckles, cracks, or evidence of damage. Changes in direction that cannot be made in accordance with allowable radius shall be made with elbow-type fittings.
- M. Steel lines will require fittings at all changes in direction.
- N. When mechanical OD compression couplings are used, polyethylene gas pipe shall be reinforced with a stiffener in the pipe bore. Stiffeners shall be properly sized for

the diameter and wall thickness of polyethylene pipe being joined. For service pipe connections, the stiffener length shall match the pipe end penetration depth into the coupling.

- O. The use of plastic pipe above ground is prohibited.

3.03 TESTING

- A. Fusion Quality. The Contractor shall ensure the field set-up and operation of the fusion equipment, and the fusion procedure used by the Contractor's fusion operator while on site. Upon request by the Owner, the Contractor shall verify field fusion quality by making and testing a trial fusion. The trial fusion shall be allowed to cool completely; then test straps shall be cut out and bent strap tested in accordance with ASTM D 2657. If the bent strap test of the trial fusion fails at the joint, the field fusions represented by the trial fusion shall be rejected. The Contractor at his expense shall make all necessary corrections to equipment, set-up, operation and fusion procedure, and shall re-make the rejected fusions.
- B. Leak Testing. Leak testing shall be conducted in accordance with Performance Pipe Technical Note 802 Leak Testing.
- C. Polyethylene gas distribution systems that are subject to D.O.T. Pipeline Safety Regulations shall be tested in accordance C.F.R. 49, Part 192, Sections 192.509, 192.511, or 192.513 as applicable.
- D. The Contractor shall take all precautions to eliminate hazards to persons near lines being tested. Pipes being tested shall be supervised at all times.

END OF SECTION

**SECTION 02555
WATER DISTRIBUTION SYSTEM**

PART 1 - GENERAL

1.01 REFERENCE STANDARDS

A. American Water Works Association (AWWA):

C500 Gate Valves 3" - 48" for Water and Other Liquids

C502 Dry-Barrel Fire Hydrants

C600 Installation of Cast Iron Water Mains

C651 Disinfecting Water Mains

C800 Threads for Underground Service Line Fittings

B. American National Standards Institute (ANSI):

A-21.10 Gray-Iron and Ductile Iron Fittings, 2"-48" for Water and Other liquids

A-21.11 Rubber Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe Fittings

A-21.4 Cement Mortar Lining for Cast Iron and Ductile Iron Pipe and Fittings for Water

A-21.51 Ductile Iron Pipe, Centrifugally Cast in Metal or Sand-Lined Molds, for Water or Other Liquids

B-18.2 Square and Hex-Head Bolts and Screws

C. American Society of Testing and Materials (ASTM):

A-47 Malleable Iron Castings

A-48 Gray Iron Casting

A-88 Seamless Copper Water Tube

A-240 Chromium and Chromium-Nickel Stainless Steel Plate Sheet and Strip for Fusion-Welded Uni-fired Pressure Vessels

A-307 Low Carbon Steel Externally and Internally Threaded Standard Fasteners

D-1784 Rigid Poly (Vinyl chloride) Compounds, and Chlorinated Poly (Vinyl Chloride) Compounds

D-2239 Polyethylene (PE) Plastic Pipe (SDR-PR)

D-2241 Poly Vinyl Chloride (PVC) Plastic Pipe (SDR-PR and Class T)

D-3139 Joints for Plastic Pressure Pipe Using Flexible Elastomeric Seals

D. Rule for Safe Drinking Water, Georgia State EPD: Chapter 391-3-5

1.02 DESIGN

- A. The design of the proposed water system shall include a hydraulic model that insures sufficient capacity and pressure at each point of delivery.
- B. The design of the proposed water system shall include horizontal alignment, all creek, wetlands, and bridge crossings, all tie-ins, future stubs, hydrants and valves included in the system.
- C. Water mains and water service lines shall be laid at least 10 feet horizontally from any existing or proposed sanitary sewer, storm sewer, septic tank, subsoil treatment system or sewer manhole. The distance shall be measured edge-to-edge.
- D. When local conditions prevent a horizontal separation of 10 feet, the water main may be laid closer to a sewer (on a case-by-case basis) provided the water main is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the water main is at least 24 inches above the top of the sewer. It is advised that the sewer be constructed of materials and with joints that are equivalent to water main standards of construction and be pressure tested to assure water-tightness prior to backfilling.
- E. Water mains and water service lines crossing house sewers, storm sewers or sanitary sewers shall be laid to provide a minimum vertical separation of at least 24 inches between the bottom of the water main and the top of the sewer. At crossings, one full length of water pipe shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required.
- F. When local conditions prevent a vertical separation of 24 inches, the sewer passing over or under water mains shall be constructed of materials and with joints that are equivalent to water main standards of construction and shall be pressure tested to assure water-tightness prior to backfilling. When water mains and water service lines cross under sewers, additional measures shall be taken by providing:

1. A vertical separation of at least 24 inches between the bottom of the sewer and the top of the water main;
 2. Adequate structural support for the sewers to prevent excessive deflection of joints and settling on and breaking the water mains;
 3. That the length of water pipe be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer; and
 4. Both the sewer and the water main shall be constructed of water main materials extending on each side of the crossing until at least 10 feet separates the two pipes and subjected to hydrostatic tests, as prescribed in this document. Other options that are acceptable include:
 - Encasement of the water main or sewer in a carrier pipe constructed of water main materials, extending on each side of the crossing until at least 10 feet separates the two pipes.
 - The sewer has a structural lining that meets ASTM F1216 extending on each side of the crossing until at least 10 feet separates the two pipes.
- G. Maximum obtainable separation of reclaimed water lines and potable water lines shall be practiced. A minimum horizontal separation of three (3) feet (outside of pipe to outside of pipe) shall be maintained between reclaimed water lines and either potable water mains or sewage collection lines. A minimum of 24 inches shall be provided between the bottom of any potable water supply line and the top of the reuse line.
- H. If the proposed development does not have an existing water main of sufficient capacity at the project entrance, the engineer shall design a water main of a size and source specified by the City of Hinesville. Such design will be submitted along with the hydraulic model, for approval by the City.

1.03 SUBMITTALS

- A. Six copies of manufacturer's drawings and catalog cuts of the following items shall be submitted for approval of the Design Engineer and the area Inspector:
1. Pipe
 2. Fittings
 3. Joints and Couplings
 4. Hydrants
 5. Valves

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Materials delivered to site shall be inspected for damage, unloaded and stored with the minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and rubber gaskets under cover and protect from exposure to direct sunlight. Store materials above ground. Interior of pipe and fittings shall be kept free of dirt and debris.
- B. Pipe, fittings, valves, hydrants and other accessories shall be handled to insure delivery to the point of installation in sound undamaged condition. If coatings or linings of pipe or fittings are damaged, such pipe or fittings shall be removed from the site and new materials furnished. Pipe shall not be dragged. Rubber gaskets that are not installed immediately shall not be left in the sunlight, but shall be stored under cover and protected from exposure to direct sunlight.

PART 2 - PRODUCTS

2.01 POLYVINYL CHLORIDE PIPE (PVC)

- A. IPS Size PVC Pipe: Class 200 SDR 21 - Polyvinyl chloride water main pipe shall conform to Designation ASTM D2241 and shall consist of Type I, Grade 1 PVC compound conforming to ASTM D1784. All pipe shall be Class 200, SDR 21. The standard laying length shall be 20 ft. ±1 inch.
- B. DIP Size PVC Pipe: AWWA C-900-07
 - 1. C-900 polyvinyl chloride water main pipe 4" TO 12" shall conform to Designation ASTM D2241 and shall consist of Type I, Grade 1 PVC compound conforming to ASTM D1784. All pipe larger than 4" to 12" shall meet the requirements of AWWA C900, "Poly Vinyl Chloride (PVC) pressure pipe." All pipe shall be class 200 pipe and shall meet the requirements of DR14. The standard laying length shall be 20 ft. ±1 inch. The FM approved pressure class will be used to determine pressure class.
 - 2. C-905 polyvinyl chloride water main pipe 14" to 30" shall be manufactured from compounds conforming to PVC cell classification of 12454B as defined in ASTM D-1784. The integral bell joint system meets the requirements of ASTM D-3139 and utilizes an elastomeric seal conforming to ASTM F-477. All pipe shall be class 200 pipe and shall meet the requirements of DR18. The standard laying length shall be 20 ft. ±1 inch.
- C. When DIP size PVC pipe is used two 2" PVC pipe shall be SDR 21, 200 PSI pressure class, iron pipe
- D. Pipe shall have integral bell and spigot joints. Provisions shall be made for contraction and expansion at each joint with an elastomeric ring. Threaded or solvent welded type joints shall not be used. Bell end pipe and couplings with elastomeric gaskets shall meet the requirements of ASTM 3139.
- E. The Contractor shall install a continuous run of 14 gauge copper tracer wire with underground coating above the top of the PVC pipe 12 inches above the pipe but no deeper than 48 inches below finished grade. The tracer wire shall be suitable for detection with metal pipe location equipment.

- F. All water pipe shall be blue in color and labeled "water" every three feet as a minimum.
- G. Pipe shall carry National Sanitation Foundation (NSF) seal and be factory marked with manufacturer's identification, pipe size, material and pressure rating.

2.02 DUCTILE IRON PIPE

- A. Ductile iron pipe shall conform to the requirements of ANSI Standard A21.51 and AWWA C151. All pipe shall class 350. Class designations for the various classes of pipe shall be painted on the outside of each joint of pipe. Weights shall be conspicuously painted in white on each joint of pipe after the bituminous coating has hardened.
- B. All joints shall have the same pressure rating as the pipe with which it is used. Joints shall be rubber gasketed push on or mechanical joint. Joints shall meet the requirements of ANSI A21.11 and AWWA C111.
- C. Pipe shall be coated inside and out with one mil. thick bituminous coating conforming to ANSI A21.4 and AWWA C110, C115OR C151. The interior shall be lined with a cement mortar lining conforming to ANSI/AWWA C104/A21.4.

2.03 GALVANIZED STEEL PIPE

- A. This pipe and fittings shall conform to the requirements of ASTM A120. The pipe shall be "standard weight", unless otherwise specified.

2.04 PLASTIC TUBING

- A. Plastic pipe shall conform to all the requirements of the "Specifications for Polyethylene (PE) Plastic Pipe (ADR-PR)", as they apply to PE 3306 of ASTM D2239.
- B. The hydrostatic design stress shall be 630 psi for water at 23° centigrade (73.4° F) and 500 psi for water at 37.8° C (100° F).
- C. The polyethylene extrusion compound from which the pipe is extruded shall meet the requirements of Type III, Grade 3, Class C material as described in "Specification for Polyethylene Molding and Extrusion Materials", ASTM D1248, except that melt index shall be determined under a higher temperature than any of the conditions as listed in Section 6(b) of "Method of Test for Measuring Flow Rates of Thermoplastics by Extrusion Plastometer", ASTM D1238. The test condition shall be the same as for condition J, except that the temperature shall be 310° C (590° F), with a load of 12-5 kilograms. Under these conditions the resin shall extrude at a maximum rate of 0.25 grams per ten (10) minutes. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions or other defects. The pipe shall be uniform in color, capacity, density, and other physical properties.
- D. The size, the type of plastic pipe material, dimension ratio, commercial standards with which the pipe complies, the manufacturer's name and the National Sanitation Foundation (NSF) seal of approval, shall be conspicuously marked on the outside of the pipe at intervals of not more than five (5) feet.

2.05 FITTINGS

- A. Ductile iron mechanical joint fittings shall conform to the requirements of ANSI/AWWA C110 and C153. The fittings shall be of the lightest class conforming to the pressure rating of the pipe lines in which they are installed, in no case shall the fittings be lighter than class 200.
- B. Fittings for galvanized steel pipe shall be malleable iron conforming to ANSI B16.3 except the nipples and couplings shall be the same material as the pipe. All fittings shall be hot-dip galvanized in accordance with ASTM A120.
- C. The mechanical joint shall meet requirements of ANSI A21.11 and shall have the same pressure rating as the fitting of which it is a part.
- D. Fittings shall be coated inside and out with one mil. thick bituminous coating conforming to ASNI A21.4.

2.06 HYDRANTS

- A. All fire hydrants shall conform to AWWA C502.
- B. All fire hydrants shall have a 6" mechanical joint inlet connection and be equipped with a 5-1/4 inch valve, two 2-1/2 inch hose nozzles and one 4-1/2 inch pumper connection, all with ANSI (National) standard threads. Operating nuts shall be 1-1/2 inch, pentagon type.
- C. All fire hydrants shall be equipped with "O" ring type stem seals.
- D. All fire hydrants shall be designed for 150 psi working pressure and 300 psi test pressure.
- E. All fire hydrants shall be equipped with a 6" gate valve, complying with other sections of the specifications, installed on the fire hydrant lead between the hydrant and the main.
- F. The Contractor shall paint the hydrant with XO-14 Tractor Red (Federal Safety Color) paint.
- G. All fire hydrants shall be designed such that clockwise rotation of the stem closes the valve and counterclockwise rotation opens the valve. Hydrant covers shall have the word "Open" and an arrow showing the proper rotation of the operating nut cast in or permanently attached.
- H. An independent drain shall be provided, completely draining the hydrant after use. The drain shall be activated to the open position by the closing of the hydrant valve. The drain rod shall be easily cleaned. The drain shall have a protective shield integral with the hydrant base to minimize clogging and prevent undermining.
- I. All working parts of the hydrant shall be easily removed for inspection or servicing without digging or the use of hoists or derricks or special tools. The hydrant cover and stand pipe shall be removable without requiring the water to be shut off.
- J. Each fire hydrant shall be equipped with a ground line mounted breakaway flange and cast-iron safety stem coupling specially designed so that upon sustaining severe

impact the hydrant will shear off at the ground line without loss of water in the main.

- K. All fire hydrants shall be Mueller standard or equal as approved by the Engineer.

2.07 METERS

- A. All meters shall be approved first line product of recognized manufacturer and shall be compatible with the meter reading system currently being used by the water system owner and operator.
- B. Meters, meter materials and meter test shall conform to applicable AWWA Specifications and shall meet or exceed current AWWA Specifications.
- C. Each meter shall have manufacturer's serial number on the lid.
- D. All body parts as cases, boxes and lids shall be of bronze composition.
- E. Meters shall be split case, positive displacement type.
- F. The register shall read in U.S. Gallons and shall be hermetically sealed and driven by permanent magnets.

2.08 METER BOXES

- A. The meter box shall be the approved standard product used by the water system owner and operator.
- B. They shall be rectangular and of adequate dimension to accommodate the specified meters.
- C. Boxes shall have cast iron or polyethylene covers labeled "WATER METER".
- D. Boxes for 5/8" by 3/4" meters shall have inside width not less than 10 inches, inside length not less than 15 inches and overall height not less than 12 inches.
- E. Boxes shall be designed and built to withstand traffic loads typical of yard installations.

2.09 VALVES

- A. All valves of the same type shall be from a single manufacturer. Parts for valves of the same type and size shall be interchangeable. Spare parts shall be furnished where required in the payment items. Special tools required for repacking or disassembling valves shall be provided.
- B. All valves shall open left (counter clockwise).
- C. All valves 2" in diameter and smaller shall be constructed of brass or bronze except that the hand wheel which shall be of malleable iron construction with screwed ends. All valves 2-1/2" in diameter and larger shall have flanged ends for interior service and mechanical joints for buried service unless otherwise approved. They

shall be iron body, bronze mounted, except that in the smaller sizes the valves may be all bronze.

D. Gate Valves:

1. Gate valves smaller than three inches shall meet the requirements of Fed. Spec. WW-V-54, Class A, 125 pounds.
2. Gate valves three inches and larger shall have nonrising stems and shall meet the requirements of AWWA Standard C-500. Valves for lighter pressures than the AWWA Standard shall meet the requirements of the above specifications except that the requirements for metal thickness and strengths and structural designs shall be adjusted as required to meet hydrostatic test pressures not less than 150 psi.
3. All gate valves shall have standard stuffing box seals. Bonnet bolts, studs and nuts shall be cadmium plated. Seating devices shall be bronze to iron or bronze to bronze. The glands shall be bronze or bronze bushed. Gland bolts and nuts shall be bronze.
4. All gate valves shall be of the double disc or wedge type. The wedge or disc shall be totally encapsulated in rubber. The sealing rubber shall be permanently bonded to the wedge or disc to meet ASTM tests for rubber metal bond ASTM D249.
5. Valves to have two inches square operating nut, with the exception that gate valves in altitude valves pits shall have hand wheels.
6. Valves buried in ground or located in vaults or structures shall have suitable extensions for socket operation with top of operating nut located two feet below finished grade maximum.
7. Any valve installed in a vault readily accessible for entry shall be equipped with handle wheels in lieu of operating nuts. No hand wheels are allowed in buried valves.

E. Check Valves:

1. Check valves 2" through 24" shall be iron body, bronze mounted swing check valves meeting the requirements of AWWA Standard C508-76.
2. The check valve shall be metal to metal or composite to metal seat construction with flange ends or screw and coupled ends.

F. Altitude Valves:

1. All altitude valves furnished for use in the systems shall be equipped for showing at all times the position of the valve. Said altitude valves shall be of the size specified on the drawings and suitable for the use intended.
2. The Contractor shall supply the services of a qualified manufacturer's representative to check and calibrate each altitude valve installation for proper working pressure and sequence.

G. Air Release Valves

1. Air release valve shall have all bronze body and bonnet. They shall be the direct acting type.
2. Valves shall be hydrostatically tested to at least 150 psi.
3. The valve shall have stainless steel floats and an internal coating with rust inhibitors.

2.10 BACKFLOW PREVENTERS

- A. The backflow preventers used shall be those specifically designed for use in connections when the danger from backflow presents a health hazard.
- B. All domestic backflow preventers shall be of the reduced pressure type or double check type as shown on plans. All fire protection system backflow preventers shall be of the double check detector type.
- C. Backflow preventers 3/4" to 2" shall be Ames LF 2000 B, LF 4000 B, or equal meeting or exceeding the following specifications:

Mainline Case – Bronze or Copper Alloy
Working Parts - Bronze & Stainless Steel
Springs - Stainless Steel
Diaphragms - Buna N and Mylar
Valve disc - Silicone Rubber
Check Valve Enclosure - Glass Reinforced Plastic
Maximum Rated Working Pressure - 175 psi
Temp. Range - 33° - 180°F

- D. Backflow Preventers 2½" to 10" shall be Ames M200, M400, or LFM300 Lead Free or equal meeting or exceeding the following specifications:

Body 8"-10" - Stainless Steel
Body 2½"-6" - Stainless Steel
Working Parts - Stainless Steel
Springs 2½"-6" - Stainless Steel
Springs 8"-10" - Stainless Steel
Valve Disc - Silicone Rubber
Maximum Rated Working Pressure - 175 psi
Temp. Range - 33° - 140°F

- E. Backflow preventers larger than 10" shall be designed for conditions that do present a health hazard. It shall be the reduced pressure type and depending on the application, may require detection of leaks or unauthorized use. Detectors above 10" shall be submitted for approval. The submittal shall include complete shop drawings. The submittal will be reviewed based on the product's ability to meet the needs of the project and the Owner.

PART 3 - EXECUTION

- A. All valves shall be carefully mounted in their respective positions free from distortion and strain. All valves shall be properly packed and left in satisfactory operating condition at the completion of the project.
- B. Valve box, cover and concrete pad shall be installed with each valve as shown in miscellaneous details.

3.01 PIPE INSTALLATION

- A. PVC pipe shall be installed in accordance with the Uni-Bell Plastic Pipe Association guide for installation of polyvinyl chloride plastic pressure pipe for municipal water main distribution system and the printed recommendations of the manufacturer.
- B. Ductile iron pipe shall be installed in accordance with AWWA C600.
- C. Pipe line alignment and gradient shall be straight, or shall follow true curves as near as practicable. Curvature in pipe lines, where required, shall be well within the allowable laying radius, horizontal and vertical.
- D. Excavation, cleaning, laying, jointing and backfilling shall follow as closely as is possible so as to progress the work. In no case shall pipe be left in the trench overnight without completing the jointing. The completed pipe line shall not be left exposed in the trench unnecessarily, and the Contractor shall backfill and compact the trench as soon as is possible after laying and jointing is completed. Each day at the close of work, and at all times when laying is not in progress, the exposed end of the pipe line in the trench shall be closed with a head or barrier of wood or metal. If at any time it becomes necessary to cover the end of any uncompleted pipe line with backfill, the end of that pipe shall be closed with a mechanical joint plug.
- E. The Contractor shall keep exposed ends of pipe properly plugged during laying to prevent dirt and other materials from entering the line, and shall also, before the system is accepted, thoroughly clean all lines.
- F. Thrust Blocks (Reaction Blocking) shall be provided as specified AWWA C600. All exposed pipes, valves, hydrants, etc., shall be securely strapped and all ends and bends braced.
- G. Other means of pipe restraining in addition to thrust blocking shall include "mega lug" utilization and all threads bolted through fittings in accordance with AWWA C600. Thrust blocking may not be eliminated with the use of joint restraint.
- H. Mechanical joints shall be made only by experienced mechanics. Sockets and spigots shall be washed with soapy water before slipping gland and gasket over spigot. The spigot shall be inserted in the socket full depth. The gasket shall be brushed with soapy water, and pushed into position making sure the gasket is evenly seated in the socket. The gland shall then be properly positioned for compressing the gasket. All bolts and nuts shall be tightened with a torque wrench to a uniform, permanent tightness. Bolts shall be tightened alternately 180 degrees apart. Sockets, spigots, glands and bolts shall be kept clean and wet with soapy water until each joint is completed.

- I. All water distribution mains shall have a minimum 36" of cover.

3.02 FIRE HYDRANT INSTALLATION

- A. All fire hydrants shall have 36" minimum pipe cover provided for the branch supply line.
- B. Each fire hydrant shall be set on a stable foundation at least 18 inches square and 6 inches thick and shall be blocked against the end of the trench with concrete and anchored.
- C. Hydrant drainage shall be provided by installing around the hydrant at least 7 cubic feet of gravel or crushed stone below the top of the hydrant supply pipe.
- D. The barrel of the fire hydrant shall be set plumb (perpendicular to the ground) with the lowest discharge outlet at least fifteen (15) inches high but no higher than 24 inches above finished grade. No fire hydrant shall be installed within 10 feet of any private driveway. Hydrants shall be located no closer than 5 feet of a curbing and no further than 12 feet of the curbing.
- E. Immediately before installation of a hydrant, the following operations shall be performed:
 1. The hydrant shall be thoroughly inspected.
 2. The hydrant interior shall be thoroughly cleaned.
 3. The hydrant shall be opened and closed to determine that all parts are in proper working order, with valves seating properly and the drain valve operating freely.

3.03 HYDROSTATIC TEST

- A. Upon completion of backfilling operations and not less than seven (7) days after the last concrete blocking anchor has been poured, the pipe system shall be subject to hydrostatic test.
- B. The system shall be filled with water and all air expelled.
- C. The Contractor shall pressurize the system to 150 pounds per square inch at the highest point in the system.
- D. The test pressure shall be maintained for two hours.
- E. If the pressure cannot be maintained, the cause shall be determined, corrected and test repeated until successful.

3.04 LEAKAGE TEST

- A. Following the pressure test, the system shall be subject to a leakage test.
- B. Leakage shall be defined as the quantity of water that must be supplied into the pipe to maintain the design working pressure after all air in the pipe line has been expelled and the pipe has been filled with water.
- C. Leakage shall not exceed the quantity determined by the formula given below:

$$L = \frac{ND (\text{Square Root of } P)}{7400}$$

WHERE

- L = allowable leakage in gallon/hr.
- N = number of joints in pipe line
- D = nominal diameter of the pipe inches
- P = average test pressure during leakage test in psig

- D. If leakage exceeds the allowable rate, leaks shall be found and repaired and the test repeated until successful.

3.05 DISINFECTION

- A. Water mains and accessories shall be disinfected in accordance with "Rules for Safe Drinking Water" as published by the Georgia Environmental Protection Division.
- B. The mains shall be flushed into the storm drainage system before disinfecting by maintaining a velocity of at least 2.5 feet per second for a period of ten minutes.
- C. The continuous feed method may be used for any size main or system where satisfactory quantity and quality water is available. The tablet method shall not be acceptable.
- D. Following disinfection of the water system, the system shall be flushed until chlorine concentration is less than 1 milligram per liter. Flushing shall not allow chlorinated water to be discharged into the storm sewer system without first allowing the chlorine in the system to dissipate. The contractor shall use a Pollard Water LPD-250 or equal equipment along with LPD-Chlor tablets (Sodium Sulfate or Ascorbic Acid) to de-chlorinate the water using 1 tablet per 2000 gallons of water minimum prior to flushing, then after adequate testing, discharge the de-chlorinated water to the storm sewer system or onto the land surface. During the de-chlorination flushing the flow through the LPD 250 will be maintained at between 200 and 1200 GPM. No flows for de-chlorination or flushing will not be allowed outside this flow specification. The contractor may apply to the owner of the sanitary sewer system to obtain permission to discharge the chlorinated water into the sanitary sewer system for a fee. The contractor shall be charged at the going rate per gallon for treating the water discharged to the sanitary sewer system.

E. Bacteriologic Tests:

1. Tests shall be performed to detect the presence of coliform organisms on samples taken from the end farthest from the point at which chlorine was introduced into the system and at 1000 ft. intervals.
2. The bacteriological sample shall meet the requirements established by EPD for suitable disinfection for human consumption.
3. If unsatisfactory samples are produced, disinfection shall be repeated until samples are satisfactory.

END OF SECTION

**SECTION 02560
NON-POTABLE REUSE WATER SYSTEM**

PART 1 - GENERAL

1.01 REFERENCE STANDARDS

A. American Water Works Association (AWWA):

C500 Gate Valves 3" - 48" for Water and Other Liquids

C502 Dry-Barrel Fire Hydrants

C600 Installation of Cast Iron Water Mains

C651 Disinfecting Water Mains

C800 Threads for Underground Service Line Fittings

B. American National Standards Institute (ANSI):

A-21.10 Gray-Iron and Ductile Iron Fittings, 2"-48" for Water and Other liquids

A-21.11 Rubber Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe Fittings

A-21.4 Cement Mortar Lining for Cast Iron and Ductile Iron Pipe and Fittings for Water

A-21.51 Ductile Iron Pipe, Centrifugally Cast in Metal or Sand-Lined Molds, for Water or Other Liquids

B-18.2 Square and Hex-Head Bolts and Screws

C. American Society of Testing and Materials (ASTM):

A-47 Malleable Iron Castings

A-48 Gray Iron Casting

A-88 Seamless Copper Water Tube

A-240 Chromium and Chromium-Nickel Stainless Steel Plate Sheet and Strip for Fusion-Welded Uni-fired Pressure Vessels

A-307 Low Carbon Steel Externally and Internally Threaded Standard Fasteners

D-1784 Rigid Poly (Vinyl chloride) Compounds, and Chlorinated Poly (Vinyl Chloride) Compounds

D-2239 Polyethylene (PE) Plastic Pipe (SDR-PR)

D-2241 Poly Vinyl Chloride (PVC) Plastic Pipe (SDR-PR and Class T)

D-3139 Joints for Plastic Pressure Pipe Using Flexible Elastomeric Seals

D. Rule for Safe Drinking Water, Georgia State EPD: Chapter 391-3-5

1.02 DESIGN

- A. The design of the proposed NPRL system shall include a hydraulic model that insures sufficient capacity and pressure at each point of delivery.
- B. The design of the proposed NPRL system shall include horizontal alignment, all creek, wetlands, and bridge crossings, all tie-ins, future stubs, and valves included in the system.
- C. NPRL and NPRL services shall be laid at least 10 feet horizontally from any existing or proposed sanitary sewer, storm sewer, septic tank, subsoil treatment system or sewer manhole. The distance shall be measured edge-to-edge.
- D. When local conditions prevent a horizontal separation of 10 feet, the NPRL may be laid closer to a sewer (on a case-by-case basis) provided the NPRL is laid in a separate trench or on an undisturbed earth shelf located on one side of the sewer at such an elevation that the bottom of the NPRL is at least 24 inches above the top of the sewer. It is advised that the sewer be constructed of materials and with joints that are equivalent to water main standards of construction and be pressure tested to assure water-tightness prior to backfilling.
- E. NPRL and NPRL services crossing house sewers, storm sewers or sanitary sewers shall be laid to provide a minimum vertical separation of at least 24 inches between the bottom of the NPRL and the top of the sewer. At crossings, one full length of water pipe shall be located so both joints will be as far from the sewer as possible. Special structural support for the water and sewer pipes may be required.
- F. When local conditions prevent a vertical separation of 24 inches, the sewer passing over or under NPRL shall be constructed of materials and with joints that are equivalent to water main standards of construction and shall be pressure tested to assure water-tightness prior to backfilling. When NPRL cross under sewers, additional measures shall be taken by providing:
 - 1. A vertical separation of at least 24 inches between the bottom of the sewer and the top of the NPRL;

2. Adequate structural support for the sewers to prevent excessive deflection of joints and settling on and breaking the NPRL;
 3. That the length of water pipe be centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer; and
 4. Both the sewer and the NPRL shall be constructed of water main materials extending on each side of the crossing until at least 10 feet separates the two pipes and subjected to hydrostatic tests, as prescribed in this document. Other options that are acceptable include:
 - Encasement of the NPRL or sewer in a carrier pipe constructed of water main materials, extending on each side of the crossing until at least 10 feet separates the two pipes.
 - The sewer has a structural lining that meets ASTM F1216 extending on each side of the crossing until at least 10 feet separates the two pipes.
- G. Maximum obtainable separation of NPR water lines and potable water lines shall be practiced. A minimum horizontal separation of three (3) feet (outside of pipe to outside of pipe) shall be maintained between NPR water lines and either potable water mains or sewage collection lines. A minimum of 24 inches shall be provided between the bottom of any potable water supply line and the top of the reuse line.
- H. If the proposed development does not have an existing NPRL of sufficient capacity at the project entrance, the engineer shall design a NPRL of a size and source specified by the City of Hinesville. Such design will be submitted along with the hydraulic model, for approval by the City.
- I. The engineer shall layout the proposed NPRL system on the development utility plan and shall include the NPRL in the roadway typical section. The NPRL mains shall be located on the same side of the road as the potable water mains, between the potable water main and the right of way. The NPRL shall be located 9' from the back of the curb.
- J. On existing City streets, the NPRL will be located 5' inside the right of way.
- K. All NPRL owned and operated by the City of Hinesville shall have a minimum pipe size of 4". If adequate flow and/or pressure is not available at the point of connection, a larger main and/or additional improvements may be required. Determination of volume or pressure inadequacy will be hydraulically modeled and calculated by the developer's engineer.

- L. Standard depth of cover is four (4) feet and shall not exceed five (5) feet in depth unless authorized by the City of Hinesville.

1.03 GENERAL

- A. All valves of the same type shall be from a single manufacturer. Parts for valves of the same type and size shall be interchangeable. Spare parts shall be furnished where required in the payment items. Special tools required for repacking or disassembling valves shall be provided.
- B. All valves shall open left (counter-clockwise).
- C. All pipe and fittings shall be Pantone 522 or 512 or a shade of purple acceptable to the City of Hinesville.
- D. No NPRL shall be less than 2".

1.04 SUBMITTALS

- A. Six copies of manufacturer's drawings and catalog cuts of the following items shall be submitted for approval of the Design Engineer:
 - 1. Pipe
 - 2. Fittings
 - 3. Joints and Couplings
 - 4. Hydrants
 - 5. Valves

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Materials delivered to site shall be inspected for damage, unloaded and stored with the minimum of handling. Store materials on site in enclosures or under protective coverings. Store plastic piping and rubber gaskets under cover and protect from exposure to direct sunlight. Store materials above ground. Interior of pipe and fittings shall be kept free of dirt and debris. Pipe with faded color not meeting acceptable color requirements will not be installed.
- B. Pipe, fittings, valves, hydrants and other accessories shall be handled to insure delivery to the point of installation in sound undamaged condition. If coatings or linings of pipe or fittings are damaged, such pipe or fittings shall be removed from the site and new materials furnished. Pipe shall not be dragged. Rubber gaskets that are not installed immediately shall not be left in the sunlight, but shall be stored under cover and protected from exposure to direct sunlight.

PART 2 - PRODUCTS

2.01 POLYVINYL CHLORIDE PIPE (PVC)

- A. Polyvinyl chloride water main pipe shall conform to Designation ASTM D2241 and shall consist of Type I, Grade 1 PVC compound conforming to ASTM D1784. All pipe

shall be Class 200-SDR 21. The standard laying length shall be 20 ft. ±1 inch and shall be purple in color throughout the PVC compound.

- B. Pipe shall have integral bell and spigot joints. Provisions shall be made for contraction and expansion at each joint with an elastomeric ring. Threaded or solvent welded type joints shall not be used. Bell end pipe and couplings with elastomeric gaskets shall meet the requirements of ASTM 3139.
- C. The Contractor shall install a continuous run of 14 gauge copper tracer wire with underground coating above the top of the PVC pipe 12 inches above the pipe but no deeper than 48 inches below finished grade. The tracer wire shall be suitable for detection with metal pipe location equipment.

2.02 DUCTILE IRON PIPE

- A. Ductile iron pipe shall conform with the requirements of ANSI Standard A21.51 and shall be class 350 pipe. Class designations for the various classes of pipe shall be painted on the outside of each joint of pipe. Weights shall be conspicuously painted in white on each joint of pipe after the bituminous coating has hardened.
- B. All joints shall have the same pressure rating as the pipe with which it is used. Joints shall be rubber gasketed push on or mechanical joint. Joints shall meet the requirements of ANSI A21.11.
- C. Pipe shall be coated inside and out with one mil. thick bituminous coating conforming to ANSI A21.4. The interior shall be lined with a cement mortar lining conforming to ANSI/AWWA C104/A21.4.
- D. All ductile iron pipe shall be coated with a sealer to prevent bleeding of bituminous coating through the paint then painted to the following specifications.
 - 1. Paint shall be Pantone 522 or 512 or a shade of purple approved by the City.
 - 2. Paint shall be manufactured in Induron, Koppers or Tnemec
 - 3. Dry film thickness shall be 1-2 mils per coat.
 - 4. Surface shall be clean and dry.
 - 5. Coverage shall be 600 SF/gallon.
 - 6. Apply coating in strict accordance with manufactures requirements.

2.03 PLASTIC TUBING

- A. Plastic pipe shall conform to all the requirements of the "Specifications for Polyethylene (PE) Plastic Pipe (ADR-PR)", as they apply to PE 3306 of ASTM D2239 and shall be purple in color.
- B. The hydrostatic design stress shall be 630 psi for water at 23° centigrade (73.4° F) and 500 psi for water at 37.8° C (100° F).
- C. The polyethylene extrusion compound from which the pipe is extruded shall meet the requirements of Type III, Grade 3, Class C material as described in "Specification for Polyethylene Molding and Extrusion Materials", ASTM D1248, except that melt index shall be determined under a higher temperature than any of the conditions as listed in Section 6(b) of "Method of Test for Measuring Flow Rates of Thermoplastics by Extrusion Plastometer", ASTM D1238. The test condition shall be the same as for condition J, except that the temperature shall be 310° C (590° F),

with a load of 12-5 kilograms. Under these conditions the resin shall extrude at a maximum rate of 0.25 grams per ten (10) minutes. The pipe shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions or other defects. The pipe shall be uniform in color, capacity, density, and other physical properties.

- D. The size, the type of plastic pipe material, dimension ratio, commercial standards with which the pipe complies, the manufacturer's name and the National Sanitation Foundation (NSF) seal of approval, shall be conspicuously marked on the outside of the pipe at intervals of not more than five (5) feet.

2.04 FITTINGS

- A. Mechanical fittings and restrained fittings shall conform to ANSI A21.53/AWWA C153 or A21.10/AWWA C110.
- B. Flanged fittings shall conform to ANSI A21.10/AWWA C110. The AWWA C110 fitting flanges shall have facing and drilling which match AWWA C115 thread-on flanges which also match ANSI B16.1 class 125 flanges except where class 250 are specifically noted.
- C. Fittings shall be available in 4" through 24" sizes and shall be cast from ductile iron in accordance with ANSI/AWWA C153/A21.53 with mechanical joint bells or push-on joint bells. Fittings shall be listed by an approved certifying agency as conforming to the requirements of ANSI/NSF 61. The working pressure shall be 350 PSI. Fittings shall be made in the USA. No foreign fittings shall be allowed. Ductile iron fittings shall be coated with 6-8 mil. nominal thickness, fusion bonded epoxy conforming to the requirements of ANSI/AWWA C550 and C116/A21.16.

2.05 HYDRANTS

- A. All fire hydrants shall conform to AWWA C502.
- B. All fire hydrants shall have a 6" mechanical joint inlet connection and be equipped with a 5-1/4 inch valve, two 2-1/2 inch hose nozzles and one 4-1/2 inch pumper connection, all with ANSI (National) standard threads. Operating nuts shall be 1-1/2 inch, pentagon type.
- C. All fire hydrants shall be equipped with "O" ring type stem seals.
- D. All fire hydrants shall be designed for 150 psi working pressure and 300 psi test pressure.
- E. All fire hydrants shall be equipped with a 6" gate valve, complying with other sections of the specifications, installed on the fire hydrant lead between the hydrant and the main.
- F. The Contractor shall paint the hydrant with Pantone 522C or 512C paint. Another shade of purple may be used if accepted by the City. In addition, a sign in accordance with the City detail must be attached to the hydrant.
- G. All fire hydrants shall be designed such that clockwise rotation of the stem closes the valve and counterclockwise rotation opens the valve. Hydrant covers shall have the word "Open" and an arrow showing the proper rotation of the operating nut cast in or permanently attached.

- H. An independent drain shall be provided, completely draining the hydrant after use. The drain shall be activated to the open position by the closing of the hydrant valve. The drain rod shall be easily cleaned. The drain shall have a protective shield integral with the hydrant base to minimize clogging and prevent undermining.
- I. All working parts of the hydrant shall be easily removed for inspection or servicing without digging or the use of hoists or derricks or special tools. The hydrant cover and stand pipe shall be removable without requiring the water to be shut off.
- J. Each fire hydrant shall be equipped with a ground line mounted breakaway flange and cast iron safety stem coupling specially designed so that upon sustaining severe impact the hydrant will shear off at the ground line without loss of water in the main.
- K. All fire hydrants shall be Mueller standard or equal as approved by the Engineer.

2.06 METERS

- A. All meters shall be approved first line product of recognized manufacturer and shall be compatible with the meter reading system currently being used by the Owner.
- B. Meters, meter materials and meter test shall conform to applicable AWWA Specifications and shall meet or exceed current AWWA Specifications.
- C. Each meter shall have manufacturers serial number on the lid.
- D. All body parts as cases, boxes and lids shall be of bronze composition.
- E. Meters shall be split case, positive displacement type.
- F. The register shall read in U.S. Gallons and shall be hermetically sealed and driven by permanent magnets.

2.07 METER BOXES

- A. The meter box shall be the approved standard product used by the City of Hinesville. Painted in accordance with NPRL standards and marked as "REUSE WATER, NOT FOR HUMAN CONSUMPTION" on the lid.
- B. They shall be rectangular and of adequate dimension to accommodate the specified meters.
- C. Boxes shall have cast iron or heavy plastic covers labeled "REUSE WATER, NOT FOR HUMAN CONSUMPTION".
- D. Boxes for 5/8" by 3/4" meters shall have inside width not less than 10 inches, inside length not less than 15 inches and overall height not less than 12 inches.
- E. Boxes shall be designed and built to withstand traffic loads typical of yard installations.

2.08 VALVES

- A. All valves 2" in diameter and smaller shall be constructed of brass or bronze except that the hand wheel which shall be of malleable iron construction with screwed ends. All valves 2-1/2" in diameter and larger shall have flanged ends for interior service and mechanical joints for buried service unless otherwise approved. They shall be iron body, bronze mounted, except that in the smaller sizes the valves may be all bronze.
- B. Gate Valves:
 - 1. Gate valves shall conform to AWWA C500-86 for double-disc gate valves or AWWA C509-87 for resilient-seated gate valves, and shall be as manufactured by American Flow Control, U.S. Pipe, Mueller or approved equal. Gate valves shall be hand operated, non-rising stem, with ductile iron bodies, and adapted for joints as indicated in the approved design drawings, or as directed.
 - 2. All gate valves shall open by turning the operating nut to the left (counter clockwise).
 - 3. Gate valves shall only be used in sizes 2" through 10".
- C. Butterfly Valves:
 - 1. Butterfly valves shall conform to the requirements of AWWA C504-87, and shall be as manufactured by American Flow Control, Henry Pratt, Allis-Chalmers, or approved equal.
 - 2. Butterfly valves shall be hand operated with ductile iron bodies, and adapted for joints as indicated in the approved design drawings, or as directed.
 - 3. All butterfly valves shall open by turning the operating nut to the left (counter clockwise). Butterfly valves shall only be used in sizes 12" and larger.
- D. Tapping Sleeves and Valves:
 - 1. The Contractor shall furnish and install tapping sleeves and valves suitable for connection to the existing NPRLs at locations indicated on the approved plans, or as directed. The Contractor shall also provide the tapping machine and competent supervision for the making of taps. It is the Contractor's responsibility to verify the type, size and O.D. and class of the existing pipe before ordering the tapping sleeve and valve.
 - 2. Prior to making the tap, the Contractor, in the presence of the City Engineer/Inspector, shall hydrostatically pressure test the complete tapping sleeve and valve installation at a test pressure of 150 PSI, or 50 PSI over the existing system static pressure, whichever is greater, **(PNEUMATIC, OR AIR-PRESSURE TESTING IS PROHIBITED)**. The Contractor shall properly support the tapping sleeve and valve using bricks, blocks, wedges, or other substantial supporting materials, which will not permit the tapping valve or tapping machine to transfer any downward rotational force to the tapping sleeve. This support shall be provided before mounting the tapping machine.

3. Tapping sleeves shall be ductile iron with mechanical joint ends as manufactured by American Flow Control, Mueller, or approved equal. Outlets shall be sized to permit a tap to be made using a full-size shell cutter. The existing pipe shall be thoroughly cleaned prior to the installation of the tapping sleeve. **THE USE OF STRAP-TYPE TAPPING SADDLES FOR TAPS LARGER THAN 2" IS NOT PERMITTED.**
4. Tapping valves shall conform to the requirements for gate valves hereinbefore stipulated, except for any modifications necessary to permit the use of full size shell cutters. If of the double-disc variety, tapping valves 16" and larger shall be installed in a horizontal configuration, and shall be supplied with a by-pass. Resilient seated tapping valves 16" and larger may be supplied without the by-pass. When using resilient seated gate valves for making taps 16" and larger, it is the Contractor's responsibility to determine the finished depth of cover that shall remain over the operating nut of the valve after installation. If finished depth of cover in a standard vertical configuration is less than 2 feet, then the tapping valve shall be supplied in a horizontal configuration with differential operator.

E. Backtaps

BACKTAPS SHALL NOT BE PERMITTED UNLESS SPECIFICALLY AUTHORIZED BY THE CITY OF HINESVILLE. ANY SAID AUTHORIZED BACKTAPS SHALL BE CONSTRUCTED USING M.J. FITTINGS AND "MEGALUG" RETAINER GLANDS, AND SINGLE JOINTS OF PIPE. THREADED ROD SHALL ONLY BE PERMITTED FROM THE STEEL CASING TO THE FIRST FITTING, AND SHALL BE WELDED FOR A MINIMUM OF 8-INCHES ON EACH ROD ALONGSIDE THE CASING. WELDING OF I-BOLTS DIRECTLY TO THE CASING FOR THE PURPOSE OF INSTALLING THREADED ROD IS NOT PERMITTED.

F. Accessory Equipment

All valves, which are to be buried in the ground, shall be provided with a valve and box cover. The Contractor shall provide suitable, permanently installed valve stem extensions and guides, which have been approved by the City of Hinesville prior to fabrication and placement.

G. Valve Markers

Valve markers shall be furnished and installed with each valve on the proposed project. The markers shall be white drivable markers #CIB-380 seventy-eight (78") inches long (manufactured by Carsonite International) and extend to the valve. The markers shall be installed as close to the valve as possible, facing the street. The marker is not to protrude the finished surface grade more than three (3') feet and no less than eighteen (18") inches above the finished grade. Each marker must be labeled on both sides in accordance with the attached detail.

H. Future Stubs

All stubs for future use must be marked with a White Drivable Marker #SNFB096-01 eight (8') feet long (manufactured by Carsonite International) and extend to the pipe. The markers shall be installed facing the street. The marker is not to protrude the finished grade less than two (2') feet and not to exceed three (3') feet. Each marker must be labeled on both sides as per the attached detail.

2.9 BACKFLOW PREVENTERS

- A. The backflow preventers used shall be those specifically designed for use in connections when the danger from backflow presents a health hazard.
- B. All backflow preventers shall be of the reduced pressure type.
- C. Backflow preventers 3/4" to 2" shall be Hersey, Model FRPII or equal meeting or exceeding the following specifications:

- Mainline Case - Bronze
- Working Parts - Bronze & Stainless Steel
- Springs - Stainless Steel
- Diaphragms - Buna N and Mylar
- Valve disc - Silicone Rubber
- O Ring - Buna N
- Check Valve Enclosure - Glass Reinforced Plastic
- Maximum Rated Working Pressure - 150 psi
- Temp. Range - 33° - 210°F

- D. Backflow Preventers 2½" to 10" shall be Model 6CM or equal meeting or exceeding the following specifications:

- Body 8"-10"- Hot Dipped Galvanized or Epoxy Coating
- Body 2½"-6" - Bronze
- Working Parts - Bronze & Stainless Steel
- Springs 2½"-6"- Stainless Steel
- Springs 8"-10"- Vinyl Coated Carbon Steel
- Diaphragms - Reinforced Elastomer
- Valve Disc - Silicone Rubber
- Maximum Rated Working Pressure - 175 psi
- Temp. Range - 33° - 140°F

- E. Backflow preventers larger than 10" shall be designed for conditions that do present a health hazard. It shall be the reduced pressure type and depending on the application, may require detection of leaks or unauthorized use. Detectors above 10" shall be submitted for approval. The submittal shall include complete shop drawings. The submittal will be reviewed based on the product's ability to meet the needs of the project and the Owner.

PART 3 - EXECUTION

- A. All valves shall be carefully mounted in their respective positions free from distortion and strain. All valves shall be properly packed and left in satisfactory operating condition at the completion of the project.
- B. Valve box and cover shall be installed with each valve as shown in miscellaneous details.

3.01 PIPE INSTALLATION

- A. PVC pipe shall be installed in accordance with the Uni-Bell Plastic Pipe Association guide for installation of polyvinyl chloride plastic pressure pipe for municipal water main distribution system and the printed recommendations of the manufacturer.

- B. Ductile iron pipe shall be installed in accordance with AWWA C600.
- C. Pipe line alignment and gradient shall be straight, or shall follow true curves as near as practicable. Curvature in pipe lines, where required, shall be well within the allowable laying radius, horizontal and vertical.
- D. Excavation, cleaning, laying, jointing and backfilling shall follow as closely as is possible so as to progress the work. In no case shall pipe be left in the trench overnight without completing the jointing. The completed pipe line shall not be left exposed in the trench unnecessarily, and the Contractor shall backfill and compact the trench as soon as is possible after laying and jointing is completed. Each day at the close of work, and at all times when laying is not in progress, the exposed end of the pipe line in the trench shall be closed with a head or barrier of wood or metal. If at any time it becomes necessary to cover the end of any uncompleted pipe line with backfill, the end of that pipe shall be closed with a mechanical joint plug.
- E. The Contractor shall keep exposed ends of pipe properly plugged during laying to prevent dirt and other materials from entering the line, and shall also, before the system is accepted, thoroughly clean all lines.
- F. Thrust Blocks (Reaction Blocking) shall be provided as specified AWWA C600. All exposed pipes, valves, hydrants, etc., shall be securely strapped and all ends and bends braced.
- G. Other means of pipe restraining shall include "mega lug" utilization and all threads bolted through fittings in accordance with AWWA C600.
- H. Mechanical joints shall be made only by experienced mechanics. Sockets and spigots shall be washed with soapy water before slipping gland and gasket over spigot. The spigot shall be inserted in the socket full depth. The gasket shall be brushed with soapy water, and pushed into position making sure the gasket is evenly seated in the socket. The gland shall then be properly positioned for compressing the gasket. All bolts and nuts shall be tightened with a torque wrench to a uniform, permanent tightness. Bolts shall be tightened alternately 180 degrees apart. Sockets, spigots, glands and bolts shall be kept clean and wet with soapy water until each joint is completed.
- I. All water distribution mains shall have a minimum 48" of cover.

3.02 HYDRANT INSTALLATION

- A. All fire hydrants shall have 36" minimum pipe cover provided for the branch supply line.
- B. Each fire hydrant shall be set on a stable foundation at least 18 inches square and 6 inches thick and shall be blocked against the end of the trench with concrete and anchored.
- C. Hydrant drainage shall be provided by installing around the hydrant at least 7 cubic feet of gravel or crushed stone below the top of the hydrant supply pipe.

- D. The barrel of the fire hydrant shall be set plumb (perpendicular to the ground) with the lowest discharge outlet at least fifteen (15) inches high but no higher than 24 inches above finished grade. No fire hydrant shall be installed within 10 feet of any private driveway. Hydrants shall be located no closer than 5 feet of a curbing and no further than 12 feet of the curbing.
- E. Immediately before installation of a hydrant, the following operations shall be performed:
 - 1. The hydrant shall be thoroughly inspected.
 - 2. The hydrant interior shall be thoroughly cleaned.
 - 3. The hydrant shall be opened and closed to determine that all parts are in proper working order, with valves seating properly and the drain valve operating freely.

3.03 HYDROSTATIC TEST

- A. Upon completion of backfilling operations and not less than seven (7) days after the last concrete blocking anchor has been poured, the pipe system shall be subject to hydrostatic test.
- B. The system shall be filled with water and all air expelled.
- C. The Contractor shall pressurize the system to 150 pounds per square inch at the highest point in the system.
- D. The test pressure shall be maintained for two hours.
- E. If the pressure cannot be maintained, the cause shall be determined, corrected and test repeated until successful

3.04 LEAKAGE TEST

- A. Following the pressure test, the system shall be subject to a leakage test.
- B. Leakage shall be defined as the quantity of water that must be supplied into the pipe to maintain the design working pressure after all air in the pipe line has been expelled and the pipe has been filled with water.
- C. Leakage shall not exceed the quantity determined by the formula given below:

$$L = \frac{ND(\text{Square Root of } P)}{7400}$$

WHERE

- L = allowable leakage in gallon/hr.
- N = number of joints in pipe line
- D = nominal diameter of the pipe inches
- P = average test pressure during leakage test in psig

- D. If leakage exceeds the allowable rate, leaks shall be found and repaired and the test repeated until successful.

3.05 DISINFECTION

- A. Non-potable reuse water lines (NPRL) and accessories shall be disinfected in accordance with "Rules for Safe Drinking Water" as published by the Georgia Environmental Protection Division.
- B. The mains shall be flushed before disinfecting by maintaining a velocity of at least 2.5 feet per second for a period of ten minutes.
- C. The continuous feed method may be used for any size main or system where satisfactory quantity and quality water is available. The tablet method shall not be acceptable.
- D. Following disinfection, the system shall be flushed until chlorine concentration is less than 1 milligram per liter.
- E. Bacteriologic Tests:
 - 1. Tests shall be performed to detect the presence of coliform organisms on samples taken from the end farthest from the point at which chlorine was introduced into the system and at 1000 ft. intervals.
 - 2. If unsatisfactory samples are produced, disinfection shall be repeated until samples are satisfactory.

END OF SECTION

**SECTION 02611
BASE AND PAVING**

PART 1 - GENERAL

1.01 APPLICABLE STANDARDS

- A. When used in this section, the term "Standard Specifications" shall mean the DEPARTMENT OF TRANSPORTATION, STATE OF GEORGIA STANDARD SPECIFICATIONS – CONSTRUCTION OF TRANSPORTATION SYSTEMS 2013 or later edition.
- B. American Society for Testing and Materials (ASTM):
 - D-698 Test for, Moisture-Density Relations for soils
 - D-1557 Test for, Moisture-Density Relations for soils

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Base: The base shall conform to Section 310, Graded Aggregate Construction, of the Standard Specifications.
- B. Prime: The prime coat shall be RC-70 and shall conform with Section 412, Bituminous Prime, of the Standard Specifications.
- C. Tack Coat: The tack coat shall be RC-70 and shall conform with Section 413, Bituminous Tack Coat of the Standard Specifications.
- D. Intermediate Course (Binder): The intermediate course shall be Superpave 12.5 mm or 19 mm Asphaltic Concrete and shall conform with Section 402, Hot Mix Asphaltic Concrete Construction of the Standard Specifications.
- E. Crack Relief Interlayer: The crack relief interlayer shall be OGI Asphaltic Concrete and shall conform with Section 415, Asphaltic Concrete Open Graded Crack Relief Interlayer of the GDOT Standard Specifications and Special Provisions.
- F. Surface Course - Asphalt Plant Mix: The surface course shall be either Superpave 9.5 mm or 12.5 mm Asphaltic Concrete and shall conform with Section 402, Hot Mix Asphaltic Concrete Construction, of the Standard Specifications.
- G. Paint: Paint for pavement marking shall be in conformance with MUTCD publication and shall conform with Section 870, Paint, of the Standard Specifications.
- H. Concrete Curb and Gutter: Shall conform to Section 441 -Concrete Curb, Gutter, Combination Curb and Gutter, Header, and Median of the Standard Specification.

PART 3 - EXECUTION

3.01 COMPACTION

- A. Sub-grade: The upper 24 inches of sub-grade soils in all cut areas and all fill areas that are to receive new pavements shall be scarified and re-compacted until a density equivalent to 95% standard Proctor maximum dry density in accordance with ASTM D698 has been obtained.
- B. Base: All base shall have minimum compaction of 100% of the maximum density obtained by the test procedure present in ASTM D1557, Method D (Modified Proctor). The maximum permissible lift thickness shall be 6 inches (compacted). The contractor shall be required to perform all work necessary to meet the minimum compaction requirements.
- C. Moisture Content: Compaction shall be performed only when the moisture content of the soil is within 4% of the optimum moisture content at the time of compaction as determined by ASTM D698. Soils are to be dried prior to compaction by discing and aeration. An Independent Testing Laboratory shall determine if soils are within the optimum moisture content. The contractor shall be required to perform all work necessary to meet the minimum compaction requirements.

3.02 CONSTRUCTION

- A. Preparation of Sub-grade: Prior to placing of base and pavements, the construction of all utility lines (water, sewer, power, gas, etc.) which are to be placed under the pavements shall have been completed.
- B. Base: The base course shall be constructed in accordance with Section 310 of the Georgia Department of Transportation Standard Specifications to the compacted thickness specified.
- C. Prime: The prime coat shall be applied at a rate of 0.25 gallons per square yard and in accordance with Section 413 of the Georgia Department of Transportation Standard Specifications.
- D. Tack Coat: The tack coat shall be applied at a rate of 0.10 gallons per square yard and in accordance with Section 413 of the Georgia Department of Transportation Standard Specifications.
- E. Crack Relief Interlayer: The crack relief interlayer shall be constructed in accordance with GDOT Section 415 of the Georgia Department of Transportation Standard Specifications and Special Provisions.
- F. Intermediate and Surface Course - Asphalt Plant Mix: The intermediate and surface courses shall be constructed in accordance with Section 402 of the Georgia Department of Transportation Standard Specifications to the thickness indicated. All thicknesses are compacted.
- G. Painting Stripe: Pavement striping is required and shall be in accordance with Georgia Department of Transportation MUTCD publication.
- H. Existing pavement which has pavement markings damaged by this construction shall be repainted.

- I. Concrete Curb and Gutter: Shall be constructed in accordance with Section 441 of the Georgia Department of Transportation Standard Specification.

3.03 TESTING

- A. Compaction testing shall be performed by an approved testing laboratory. Subgrade and base compaction testing shall be performed at a spacing not to exceed 500' staggered for the entire length of the street. On streets shorter than 1,000' the testing spacing shall reduce to 300' and in no case will be less than three tests per street, equally spaced. The Design Engineer and Construction Inspector shall be provided copies of the test information prior to placement of base material or final pavement.
- B. Prior to the installation of any base material a test roll must be performed along the entire roadway length, both sides of the road. The test roll shall be performed utilizing an 18 C.Y. tandem axle dump truck loaded with at least 12 C.Y. of soil or gravel. The same test roll will be required on the base material prior to beginning pavement installation. The Design Engineer and Construction Inspector shall be present during the test roll.
- C. Prior to beginning the installation of any asphalt pavement, the base material shall be tested to determine thickness and graded cross section of the base material. The contractor shall provide labor and equipment to auger through the base material to check to ensure the thickness specified in the plans and specifications has been achieved. In addition, the cross slope of the base and the depth below the gutter face shall be checked, utilizing a string line, to ensure proper crown and asphalt depth at the edge has been achieved with the base grading. If the depth of base material is insufficient the base present will be removed, the subgrade lowered, and adequate base material will be replaced to achieve the required thickness. If the cross slope or edge depth is determined to be less than the specified thickness, the area will be rejected until the area is re-graded to the slope and the thickness specified on the approved plan.
- D. The Owner at his option may check the thickness of the asphalt pavement and base material after the installation is complete. If the Owner finds the materials to be less than specified, the contractor/developer shall take necessary measures to meet the requirements of the approved plans and specifications.
- E. Prior to any striping being performed, the contractor shall prepare a striping plan for approval by the Construction Inspector.

3.04 EXISTING PAVEMENT RESTORATION

- A. Pavement damaged due to construction shall be patched or replaced in accordance Section 400 of the Georgia Department of Transportation Standards and Specifications.
- B. Pavement damaged by new utility trenches shall be restored in accordance with the pavement removal and replacement details. Any pavement removed must be disposed of by the contractor at a permitted site.

- C. Existing inlets, manholes, or valve boxes shall be adjusted by the Contractor to the new grade lines and elevations. All adjustments to structures in areas proposed for pavement shall be accomplished prior to construction of the surface course.
- D. Adjustment to grade of existing frames shall include raising or lowering the upper portion of the structure, including any necessary sleeve extensions, adjustable manhole rings, gaskets, mortar, masonry, or other approved material, to bring the frame to the required grade.

3.05 STRIPING OF PAVEMENT MARKINGS

- A. Striping shall consist of furnishing and applying traffic markings with paint or thermoplastic in accordance with the contract drawings and specifications, and the requirements of the current Federal and State "Manual On Uniform Traffic Control Devices."
- B. Thermoplastic Plastic Stripe shall consist of solid or broken (skip) lines, words and/or symbols of the type, color and the location shown on the plans. It is the intent of these specifications that short lines which are defined to be crosswalks, stop bars, arrow symbols and crosshatching shall be extruded. All other lines, unless otherwise specified, shall be sprayed.
- C. Cleaning: All pavement areas to be striped shall be thoroughly cleaned. Cleaning may be accomplished by the use of hand brooms, rotary brooms, air blasts, scrapers or other approved methods which leave the paving surface thoroughly clean and undamaged. Particular care shall be taken to remove all vegetation and road film from the area to be striped.
- D. Warranty: The Contractor shall transfer to the Governing Authority the warranty on Thermoplastic materials issued by the Manufacturer.

END OF SECTION

**SECTION 02616
PAVEMENT REMOVAL AND REPLACEMENT**

PART 1 - GENERAL

1.01 DEFINITION

- A. When used in this section, the term "Standard Specifications" shall mean the DEPARTMENT OF TRANSPORTATION, STATE OF GEORGIA STANDARD SPECIFICATIONS FOR CONSTRUCTION OF ROADS AND BRIDGES, 2001 Edition or later edition, unless amended herein.

1.02 DESCRIPTION

- A. Related Work Specified Elsewhere:
 - 1. Trench Excavation, Backfill and Compaction-Section 02221.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Base: Granular material to meet the following gradation:

<u>SIEVE SIZE</u>	<u>PERCENT PASSING BY WEIGHT</u>
1-1/2"	100
3/4"	60-100
10	30-55
60	8-35
200	5-20

- B. Concrete: 3000 psi compressive strength
- C. Prime Coat: RC-70 Georgia DOT Specifications
- D. Asphalt Surface Course: The surface course shall be either Superpave 9.5 mm or 12.5 mm Asphaltic Concrete and shall conform with Section 402, Hot Mix Asphaltic Concrete Construction, of the Standard Specifications.

PART 3 - EXECUTION

3.01 CONCRETE PAVEMENT REPLACEMENT (DRIVEWAYS)

- A. Existing pavement shall be removed to a minimum of 12 inches on either side of the trench.
- B. Following trench backfilling and compaction, the depth of concrete pavement replaced shall match the existing pavement or shall be a minimum of 6 inches thick, whichever is greater.
- C. Joints and finish of the concrete slab shall match existing pavement.

- D. Pavement replacement for each driveway shall be accomplished with one pour. Deviation must be approved by the Engineer.
- E. All joints shall have waterproof sealer to avoid water intrusion and deterioration of the patch.

3.02 CONCRETE PAVEMENT REPLACEMENT (ROADWAY)

- A. Existing pavement shall be removed to a minimum of 12 inches on either side of the trench.
- B. A minimum 8 inch concrete slab containing black dye in the top 2 inches (minimum) shall be placed extending 12 inches on either side of the trench and on undisturbed soil.
- C. Depth of concrete pavement replaced shall match the existing pavement or shall be a minimum of 8 inches thick, whichever is greater.
- D. Joints and finish of the slab shall match existing pavement. Joints shall have expansion material between old and new paving.
- E. All slabs shall be installed in one pour unless directed otherwise by the Engineer. If construction joints are required, measures must be taken to avoid deterioration of the patch later by water intrusion.

3.03 ASPHALT PAVEMENT REPLACEMENT

- A. Existing pavement shall be removed to a minimum of 12 inches on either side of the trench.
- B. Granular base material shall be placed to a minimum depth of 8 inches and compacted to 95% maximum dry density following trench backfilling and compaction.
- C. If so directed by the Engineer the base shall be a 6 inch concrete slab extending 12" on either side of the trench and on undisturbed soils, then a 2 inch asphalt surface course shall be placed after a prime coat is applied to the concrete slab at the rate of 0.25 gallons per square foot to bring the paving to grade.

3.04 MAINTENANCE OF SURFACE

- A. Pavement damage due to settlement of backfill: Repair for period of bond.
- B. Depressions more than 6 inches deep in aggregate surfaced areas: Fill to grade for period of bond.

3.05 TESTING

- A. Certified laboratory reports shall be required to ensure the subgrade has been compacted to 95% and the base compacted to 100% standard proctor.

END OF SECTION

**SECTION 02650
SANITARY SEWERS**

PART 1 - GENERAL

1.01 APPLICABLE STANDARDS

A. American National Standards Institute (ANSI):

- A21.4 Cement-Mortar Lining for Cast-Iron and Ductile-Iron Pipe and Fittings for Water
- A21.6 Cast-Iron Pipe Centrifugally Cast in Metal Molds, for Water or Other Liquids
- A21.11 Rubber Gasket Joints for Cast-Iron and Ductile-Iron Pressure Pipe and Fittings
- A21.51 Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids

B. American Society of Testing and Materials (ASTM):

- A48 Gray Iron Castings
- C12 Installing Vitrified Clay Sewer Pipe
- C425 Compression Joints for Vitrified Clay Bell and Spigot Pipe
- C478 Precast Reinforced Concrete Manhole Sections
- C594 Compression Couplings for Vitrified Clay Plain-End Pipe
- C700 Extra Strength and Standard Strength Clay and Perforated Clay Pipe
- D1784 Rigid Poly (Vinyl Chloride) Compounds and Chlorinated Poly (Vinyl Chloride) Compounds
- D2241 Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR and Class T)
- D2321 Underground Installation of Flexible Thermoplastic Sewer Pipe
- D2774 Underground Installation of Thermo-plastic Pressure Piping
- D3034 Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- D3139 Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals
- D3212 Sewer Pipe Joints using Elastomeric Seals

C. American Water Works Association (AWWA):

- C-600 Installation of Cast-Iron Mains

1.02 SUBMITTALS

- A. Materials used in the sanitary sewer system shall be submitted for approval to the Design Engineer. The Design Engineer shall review the drawings, provide a list of materials and certify compliance to the Owner.
- B. Six copies of shop drawings or manufacturer's standard drawings or catalog cuts shall be submitted for the following:
 - 1. Precast concrete manholes
 - 2. Manholes and Frames
 - 3. Gaskets - One of each type
 - 4. Pipe - One of each type
 - 5. Valves - One of each type

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall be responsible for handling and storage of all materials and damaged materials shall not be used in the work. Materials delivered to the site shall be promptly inspected for damage upon arrival. Damaged or defective materials to be immediately removed from the site.
- B. All materials to be stored at least 12 inches above grade. Inside of pipes and fittings shall be kept free of dirt and debris. Rubber gaskets and plastic pipe not used immediately shall be protected from direct sunlight. Manhole units shall be handled with care to avoid chippage or breakage.

PART 2 - PRODUCTS

2.01 POLYVINYL CHLORIDE PIPE AND FITTINGS

- A. Polyvinyl chloride pipe and fittings for gravity sewers shall be SDR – 26, meeting ASTM D3034 for type PSM Polyvinyl Chloride (PVC) sewer pipe. The joints shall be Push-On "O" ring gasket type with integral bell and spigot meeting ASTM 3212. Threaded or solvent welded type joints shall not be used.
- B. Polyvinyl chloride pressure pipe shall meet the following specifications:
 - 1. IPS Size PVC Pipe: Class 200 SDR 21 - Polyvinyl chloride water main pipe shall conform to Designation ASTM D2241 and shall consist of Type I, Grade 1 PVC compound conforming to ASTM D1784. All pipe shall be Class 200, SDR 21. The standard laying length shall be 20 ft. ±1 inch.
 - 2. DIP Size PVC Pipe: AWWA C-900-07
 - a. C-900 polyvinyl chloride water main pipe 4" TO 12" shall conform to Designation ASTM D2241 and shall consist of Type I, Grade 1 PVC compound conforming to ASTM D1784. All pipe larger than 4" to 12" shall

meet the requirements of AWWA C900, "Poly Vinyl Chloride (PVC) pressure pipe." All pipe shall be class 200 pipe and shall meet the requirements of DR14. The standard laying length shall be 20 ft. ±1 inch. The FM approved pressure class will be used to determine pressure class.

- b. C-905 polyvinyl chloride water main pipe 14" to 30" shall be manufactured from compounds conforming to PVC cell classification of 12454B as defined in ASTM D-1784. The integral bell joint system meets the requirements of ASTM D-3139 and utilizes an elastomeric seal conforming to ASTM F-477. All pipe shall be class 200 pipe and shall meet the requirements of DR18. The standard laying length shall be 20 ft. ±1 inch.
- c. When DIP size PVC pipe is used two 2" PVC pipe shall be SDR 21, 200 PSI pressure class, iron pipe

C. Marking: Pipe shall be clearly marked with:

- 1. Manufacturer's Identification
- 2. Nominal Pipe Size
- 3. Material, Type and Grade
- 4. SDR or Pressure Rating
- 5. All gravity sewer pipe shall be green. Force main pipe shall be white or brown.
- 6. All pipe regardless of color shall be clearly marked "**SEWAGE FORCE MAIN**" or "**GRAVITY SEWER**" as appropriate, marked every three feet.

2.02 DUCTILE IRON PIPE AND FITTING

A. Type: Coated Ductile

B. Joints:

- 1. Push on type in accordance with ANSI A21.11.
- 2. Mechanical joint in accordance with ANSI A21.11 and fittings may be in accordance with A21. 53.

C. Ductile iron pipe shall conform to ANSI A21.51.

D. Pipe shall have a Protecto 401 lining or equal. The lining should have a high resistance to fatty oils, detergents and sewage generated hydrogen sulfide.

E. Pipe shall be coated outside with one mil. thick bituminous coating conforming to ANSI A21.4 and AWWA C110, C115OR C151.

2.03 REINFORCED CONCRETE PIPE AND MANHOLES (WET WELLS OR VALVE PITS)

A. Precast concrete sections to be manufactured in accordance with provisions of ASTM C478. As a minimum, the interior of all sections shall be coated with two coats of bituminous coating. The first coat shall be spray applied and the second

coat should be roller applied. In addition, in extremely corrosive environments, to include force main receiving manholes, wet wells, and the first two manhole from the force main connection shall be lined with sealed HDPE sheet liner. The HDPE liner shall have a watertight seal at all joints and penetrations. The liner shall be Agru Sure Grip Liner or equivalent.

- B. Precast concrete riser sections to be 48 inches in diameter with minimum wall thickness of 4 inches.
- C. Precast concrete base units to have minimum wall thickness of 5 inches.
- D. Jointing material shall be rubber gasket type conforming to ASTM C443 or vulcanized butyl rubber base flexible joint sealer in rope form conforming to Federal Specification SS-S-00210, Kent-Seal No. 2 or approved equal. The inside and outside of the joint shall be finished with mortar. Mortar shall be one part Portland cement and two parts sand.
- E. Manhole base sections shall provide for a flexible watertight union between pipe and manhole base. Manhole sleeves shall be of high-quality synthetic rubber with tensile strength of 1,500 psi, resistant to raw sewage, ozone, acids, and weathering, flexible at temperatures below 0°F and resistant to heat as high as 250°F. A substantial, serrated flange of the sleeve material shall be integrally cast into the wall of the manhole base forming a tight water seal. The sleeve shall protrude through the wall of the base. A watertight union shall be secured with the end of the pipe with stainless steel strap clamps. Manhole sleeves shall be Interpace Corp. Lock Joint Manhole Sleeves or approved equal.
- F. Pick up holes shall not penetrate the interior walls or the riser.

2.04 MANHOLE FRAMES AND COVERS

- A. Frames and covers to have machined bearing surfaces.
- B. Covers to have checkered top design and marked "Sanitary Sewer" and include the name of the utility owner.
- C. Combined weight of frame and cover shall be approximately 450 pounds.
- D. Frame shall have a depth of approximately 9 inches and an access opening of not less than 20 inches.
- E. Covers shall have two pick holes located at edges.
- F. Materials shall conform to ASTM A48 for Class 30 gray iron castings.

2.05 MANHOLE STEPS

- A. Manhole steps shall be constructed of a number 3 reinforcing bar encapsulated in polypropylene plastic with a non-skid tread.
- B. Finished dimensions of the steps shall be identical to that of malleable iron manhole steps.
- C. Steps to have a minimum tread width of 12 inches.

2.06 NUTS AND BOLTS

- A. Stainless Steel Flanged: Square head MB/SF, hexagon nuts; ASTM 307B; ANSI B18.2, zinc plated.

2.07 GASKETS

- A. Flanged pipe gaskets shall conform to requirements of ASA A21.10 and shall be suitable for the indicated services.

2.08 VALVES

- A. All valves two inches in diameter and smaller shall be constructed of brass or bronze except the hand wheel, which shall be of malleable iron construction. Valves two inches in diameter and smaller shall have screwed ends unless approved otherwise. All valves 2½ inches in diameter and larger shall have flanged ends unless otherwise approved. They shall be iron body, bronze mounted, except that in the smaller sizes the valves may be all bronze at the contractor's option and expense.
- B. The contractor shall prepare and submit for approval complete detailed drawings of all valves in accordance with the requirements of the appropriate section of these specifications. All valves of the same type shall be from a single manufacturer. Parts of valves of the same type and size shall be interchangeable. Spare parts shall be furnished as specified under the proposal items. Special tools required for repacking or disassembling valves shall be provided.
- C. All valves shall be carefully mounted in their respective positions free from all distortion and strain. All valves shall be properly packed and left in satisfactory operating condition at the completion of the project. All valves shall open left.
- D. Gate Valves
 1. Gate valves should not be used in raw sewage applications. Gate valves should only be used where primary and partial secondary treatment has already occurred.
 2. Unless otherwise specified or directed, gate valves three inches and larger shall have non- rising stems and shall meet the requirements of AWWA Standard C-500. Valves for lighter pressures than the AWWA Standard shall meet the requirements of the above specifications except that the requirements for metal thicknesses and strengths and structural designs shall be adjusted as required to meet hydrostatic test pressures not less than 125 psi.
 3. Unless otherwise specified or directed, gate valves smaller than three inches shall meet the requirements of Federal Specification WW-V-54, Class A, 125 pounds.
 4. All gate valves shall have standard stuffing box seals. Bonnet bolts, studs and nuts shall be cadmium plated. Seating devices shall be bronze to iron or bronze to bronze as specified or required. The glands shall be bronze or bronze bushed. Gland bolts and nuts shall be bronze.

5. All gate valves 2½ inches in diameter and larger shall be of the double disk type. All gate valves two inches in diameter and smaller may be of the double disk or the solid wedge type.

E. Plug Valves

1. All plug valves shall be the two-way type.
2. Nonlubricated, eccentric with resilient faced plugs.
3. Port area of 4 to 20 inch valves shall be at least 70 percent of full pipe area.
4. Valves to be designed for 125 psi working pressure.
5. Bodies to be semi steel with raised seats.
6. Seats to have either a welded-in overlay of approximately 90 percent pure nickel on surfaces contacting the plug face or shall be bronze conforming to ASTM B-62 and attached to the body by stainless steel set screws.
7. Upper and lower plug stem bushings to be stainless steel and shall be permanently lubricated.
8. Exposed nuts, bolts and washers to be zinc plated.
9. Flanges to be faced and drilled to ASA 125-pound standard.

F. Check Valves

1. Type: Ball Check
 - a. Static head must exceed 10 feet to use ball check valves.
 - b. No ball check valve will be mounted vertically to compensate for low static head.
 - c. Ball check ends must be flanged.
 - d. The body shall be cast iron, ASTM A159-72, Class 35.
 - e. The ball shall be hollow steel with vulcanized nitrile rubber covering.
 - f. Pressure rating shall be 150 psi.
 - g. Valve to be Flygt HDL or equal.
2. Lever Actuate Spring Check Valve
 - a. Where static head is less than 10 feet lever action swing check valves shall be used.
 - b. Lever action swing checks may be spring and lever type or weight on lever type as approved by the design engineer and the Owner.

- c. Valves shall be installed in the horizontal position.
- d. The valve body, disc, cover and lever shall be cast iron, ASTM A159-72, Class 35.
- e. The disc arm shall be cast steel
- f. The seat ring shall be bronze or stainless steel.
- g. All studs, bolts or nuts shall be commercial grade steel.
- h. The gate shall be rubber faced.
- i. The hinge shaft shall be stainless steel.
- j. The chamber shall be bronze.
- k. The valve shall be Clow F5340 (outside spring and lever) or Clow F5345 (outside weight and lever) or an approved equal.

G. Automatic Sewage Air Release Valve

1. The automatic sewage air release valve shall be designed to allow entrapped air to escape from the sewage force main line. After the air escapes out of the air release valve, the valve shall shut-off until more air accumulates in it and the opening cycle will repeat automatically.
2. The sewage release valve must have a compound internal linkage of precision molded delfin or stainless steel. All other internals must be stainless steel to positively prevent galvanic action. The float rod shall be 20" long to provide an air gap between the linkage and waste level inside the valve to retard the waste solids from clogging the linkage. The stainless-steel float must withstand a minimum 1000 psi pressure. Each valve shall be complete with hose and blow off valves to permit back flushing without dismantling valve.

Body and cover cast iron	ASTM A48 Class 30
Internal Delfin linkage	ASTMD2133 (or Stainless Steel)
Stainless Float	ASTM A240
Buna-N	ASTM SB800

3. Typical installation will utilize standard body valve. Valve height 28"-with back flushing attachments-33-1/2". If depth of trench is not deep enough, furnish short valve. Valve height 17-1/2" -with back flushing attachments-23-1/2".
4. Automatic sewage air release valve to be as manufactured by Crispin, Val-matic, or APCO equal to APCO Series 400 with accessories.

2.09 ACCESSORIES, PLUG, AND GATE VALVES

- A. Valves to have two-inch square operating nut unless otherwise indicated.

- B. Valves buried in ground or located in vaults or structures to have suitable extensions for socket operation with top of operating nut located two feet below finished grades maximum.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Plastic piping installation shall be in accordance with ASTM D2321 Recommended Practice for non-pressure pipe and ASTM D2774 Recommended Practice for pressure pipe.
- B. Ductile iron pressure piping shall be installed in accordance with AWWA Standard C600.
- C. Material selection for piping material shall be as indicated. If piping materials are not indicated the Contractor has the option of selecting materials in accordance with this section.
- D. Sewer mains and sewer service lines shall be laid at least 10 feet horizontally from any existing or proposed water main, storm sewer, septic tank, subsoil treatment system or sewer manhole. The distance shall be measured edge-to-edge.
- E. When local conditions prevent a horizontal separation of 10 feet, the sewer may be laid closer to a water main (on a case-by-case basis) provided the sewer is laid in a separate trench or on an undisturbed earth shelf located on one side of the water main at such an elevation that the bottom of the water main is at least 24 inches above the top of the sewer.
- F. Sewer and sewer service lines crossing water mains, or water service lines, shall be laid to provide a minimum vertical separation of at least 24 inches between the bottom of the water main and the top of the sewer. At crossings, one full length of water pipe shall be located so both joints will be as far from the water main as possible. Special structural support for the water and sewer pipes may be required. Where the vertical or horizontal separation cannot be accomplished, then concrete encasement shall extend a minimum of 10' on both sides of crossing.
- G. Sewer and sewer service lines crossing storm sewer, shall be laid to provide a minimum vertical separation of at least 24 inches between the bottom of the storm pipe and the top of the sewer. At crossings, one full length of water pipe shall be located so both joints will be as far from the water main as possible. Special structural support for the water and sewer pipes may be required.
- H. When local conditions prevent a vertical separation of 24 inches, the sewer passing over or under water mains shall be constructed of materials and with joints that are equivalent to water main standards of construction and shall be pressure tested to assure water-tightness prior to backfilling. When water mains and water service lines cross under sewers, additional measures shall be taken by providing:
 - 1. A vertical separation of at least 24 inches between the bottom of the sewer and the top of the water main;

2. Adequate structural support for the sewers to prevent excessive deflection of joints and settling on and breaking the water mains;
 3. That the length of sewer pipe be centered at the point of crossing so that the joints will be equidistant and as far as possible from the water pipe; and
 4. Both the sewer and the water main shall be constructed of water main materials extending on each side of the crossing until at least 10 feet separates the two pipes and subjected to hydrostatic tests, as prescribed in this document. Other options that are acceptable include:
 - Encasement of the water main or sewer in a carrier pipe constructed of water main materials, extending on each side of the crossing until at least 10 feet separates the two pipes.
 - The sewer has a structural lining that meets ASTM F1216 extending on each side of the crossing until at least 10 feet separates the two pipes.
- I. Pipe laying to proceed up-grade with pipe bells or groove on the upper end. Pipe to be laid with joints close and even, butting all around. Sagging joints will not be tolerated.
 - J. Pipe shall be straight and of uniform grade between manholes, laid to line and grade.
 - K. All sewer shall be designed and constructed to give velocities of not less than 2.0 FPS. Since the Owner has adopted a low flow plumbing device ordinance, the following slopes will be used.

Minimum Slope in Feet	
<u>Sewer Size</u>	<u>Per 100 Feet</u>
8"	0.44
10"	0.30
12"	0.24
15"	0.15
18"	0.12
21"	0.10
24"	0.08
30"	0.058
36"	0.046

- L. An allowable deviation from the design grades will be allowed up to 5% of the grade shown on the plan. If the grade is steeper than allowed 5% deviation the engineer must verify that the project was installed to all minimum requirements and determine the impact of the additional grade. If the grade is flatter than the 5% deviation, then it exceeds the allowable tolerance and the installation of that line is not acceptable and must be replaced. All sewer mains installed will be field checked for grades during preparation of "Record drawings".
- M. Bell holes shall be dug so the pipe barrel will carry the load of the pipe. Pipe shall be bedded in undisturbed earth or, where rock occurs, on a thoroughly compacted layer of #57 stone or sand fill of a minimum thickness of 6 inches under the barrel or bell of the pipe.
- N. Where sewers or force mains are to be connected to existing manholes or other structures, and where no stub or opening has been provided for the connection, the Contractor shall make an opening of minimum diameter through the side wall of the structure utilizing a professional coring machine and installing a boot for inserting the sewer pipe. The boot and stainless-steel strap shall be sized and installed to create a water tight seal.
- O. Lateral connection made to the sewer prior to back-filling shall be laid on a slope not exceeding 2 feet vertical to 1 foot horizontal, and not less than 1/8 inch per foot, so that the lateral shall have a solid bearing on undisturbed earth as stipulated for pipe sewers. The lateral shall make such a horizontal angle with the sewer line that a proper connection with the wye or tee branch or slant is obtained without trimming the pipe and with no danger of jointing material being forced into the sewer. All laterals shall be closed by means of suitable stoppers or end caps.
- P. Wye or tee branches shall be field located for service to all subdivided lots or inhabitable structures unless otherwise directed by the Architect/Engineer. Wye branches shall be installed so that the lower lip of the branch is not more than 2 inches below the outside top of the pipe. Tees shall be installed with the branch 45° to vertical. After installation, wye or tee branches shall not be covered with backfill until determination and record has been made of the locations of each with reference to the nearest manhole downstream and the direction in which the wye faces.
- Q. All laterals shall be properly marked on ground surface at the point where laterals terminate with treated timber markers. Timber markers shall consist of a 2 inch by 4 inch timber extending from the end of the lateral vertically to within 2 inches of the ground surface. All such markers shall be securely anchored and maintained in a proper vertical position until backfilling has been completed. The top end of such markers shall be marked or left exposed until an "as-built" survey has been made.
- R. The top rim of manhole frames and covers shall be set to conform to grades and transverse slopes. Generally, along outfall lines, the manhole frames and covers shall extend approximately 6 inches above finished grade or to a designated elevation for flood protection. Generally, where lines are located along streets, the manhole frames and covers shall be set flush with the surface.
- S. The Contractor shall install a continuous run of plasticized metallic tape above the top of the sewer main at 12 inches to 18 inches below finished grade. Tape shall be suitable for detection with metal pipe location equipment labeled "sewer buried below," and brightly colored to contrast with the soil.

- T. A 14 gauge copper tracer wire with underground coating shall be installed along the route of pressure sewers. The wire shall be located 12 inches above the pipe but no deeper than 48 inches.
- U. All PVC pressure pipe shall have a minimum of 36" cover. Areas where the cover is not maintained may require the use of extra strength (D.I.) pipe as directed by the engineer.
- V. All sewer mains will be installed at a constant grade and line as shown on the plans. If after video inspection "sags" are found in the line, then the depth of the sag will be determined by the utility owner. If the sag is determined to be deeper than the following chart then the line will be removed and replaced to meet the minimum requirements of these specifications.

Pipe Size	Max. Sag Depth
8"	0.50"
10"	0.50"
12"	0.75"
15"	0.75"
18"	0.75"

3.02 PRESSURE TESTS

- A. **FORCE MAINS:** The Contractor shall test by hydrostatic pressure to 150 pounds per square inch. Each section tested shall be slowly filled with water, care being taken to expel all air from the pipes. The required pressure shall be applied for not less than two hours. No pipe installation will be accepted until the leakage during the pressure test is less than the number of gallons listed below for each 1000 feet of pipe.

6" - 1.5 gallons	12" - 2.75 gallons
8" - 1.75 gallons	14" - 3.00 gallons
10" - 2.75 gallons	16" - 3.5 gallons

- B. **GRAVITY MAINS:** On All sewer mains less than 8' deep, the Contractor shall pressure test the gravity mains with air. Each section including manholes shall be pressurized to 3.5 psi. The allowable pressure drop of 0.5 psi on any portion of the system shall not be less than the times shown on the following chart.

<u>PIPE SIZE</u>	<u>MINIMUM TIME</u>
4"	3 MIN.
6"	4 MIN.
8"	6 MIN.
10"	7 MIN.
12"	8 MIN.

If the main will not maintain the specified pressure, the Contractor will isolate the weak joint and repair. The test will be repeated until successful. The service lines must be installed at least to the back of the curb prior to testing. These pressure

drops represent a maximum infiltration/exfiltration rate of 25 gallons per inch of pipe diameter per mile per 24-hour period.

3.03 ALLOWABLE INFILTRATION/EXFILTRATION

- A. If any visible flow is observed in the pipe during installation or final inspection a weir test will be conducted.
- B. The leakage inward or outward (infiltration or exfiltration) of the entire system including the sewer mains, service sewers, manholes and wet wells shall not exceed 25 gallons per inch of pipe diameter per mile per day for any section of the system.
- C. The weir shall be installed in each manhole. The manhole will then be filled with water to a depth of 3' from the top of the pipe, which should be at the bottom of the weir. The water level will stand for one (1) hour to stabilize then filled (if necessary) to the initial level. During the next hour the water level will be observed and the amount flowing through the weir or the amount of water required to maintain the level will be measured. This measured amount should not exceed the allowable.

3.04 INSPECTION

- A. Upon complete installation of the gravity sewer, the Contractor must enter a waiting period of not less than 10 days prior to inspection. In order to initiate the waiting period, the Contractor must notify the Design Engineer and the Owner's inspector in writing of the status of the sewer.
- B. After completion of the waiting period all sewer mains must pass a 5% deflection mandrel pulled by hand. If a 5% deflection mandrel will not pass through any section, that section will be replaced or rerounded at the expense of the Contractor. Mandrel to be supplied by the Owner's inspector or by the Contractor, if requested by the Owner.
- C. Once the mandrel and physical inspection is complete the contractor will schedule a time when the owner may internally inspect the sewer main utilizing a sewer camera and generating a video inspection of the system. If any defects are found in the system as a result of the internal inspection, then that section of the sewer main and any mains feeding into that system will not be accepted.
- D. No sewer main will be accepted if there is any evidence of sagging or bowing in the line which will adversely affect the performance of the pipe. Nor will any sewer mains be accepted if they are laid on a grade substantially less than specified on the Construction Plans. No line will be accepted if laid on less grade than the minimum stated in this specification.
- E. All manholes will be inspected for general appearance, cracks, leaks, proper installation of frame and cover, steps and inverts. Any manholes, which do not conform to the specifications, will not be accepted until the deficiency is corrected by the Contractor.
- F. All 4" sewer services will be tested for continuity and minimum bends by passing a standard tennis ball. Each sewer service shall be temporarily capped during construction. During the inspection, a tennis ball will be dropped down the open end of

the sewer service. If the ball does not appear in the lower manhole the contractor will excavate the service, correct the blockage and repeat the test until successful.

- G. All manhole and wet well liner systems shall be tested using the "Spark Test" to locate incomplete welds or penetrations in the liner not adequately sealed for gas containment.

3.05 CLEANING

- A. Contractor to clean the completed system of any debris or obstructions prior to Final Inspection.

END OF SECTION

**SECTION 02711
CHAIN LINK FENCE**

PART 1 - GENERAL

1.01 APPLICABLE STANDARDS

- A. American Society for Testing and Materials (ASTM):
 - A 90 Weight of Coating on Zinc-Coated (Galvanized) Iron and Steel Articles
 - E 8 Tension Testing of Metallic Materials

1.02 DEFINITIONS

- A. Chain Link Fence Fabric: Chain link fence fabric shall be fencing material made from wire helically wound and interwoven in such a manner as to provide a continuous mesh without knot or ties except in the form of knuckling or of twisting and barbing the ends of the wires to form the selvage of the fabric.
- B. Knuckling: Knuckling is the term used to describe the type of selvage obtained by interlocking adjacent pairs of wire ends and bending the wire ends back into closed loop.
- C. Twisting and Barbing: Twisting and barbing is the term used to describe the type of selvage obtained by twisting adjacent pairs of wire ends together in a close helix of 1½ machine turns which is equivalent to three full twists and cutting the wire ends at an angle to provide sharp points.

PART 2 - MATERIALS AND INSTALLATION

2.01 FABRIC

- A. Chain link fabric shall be Commercial Grade No. 9 gauge core galvanized wire, with 2-inch mesh and zinc-coated by electrolytic or hot dipped process before fabrication.

2.02 FABRIC COATING

- A. If specified for on the plans, the chain link fabric coating shall be vinyl and be dipped after material is helically wound. The vinyl coating shall have a 6-gauge finish over a 9-gauge core.

2.03 CORNER AND TERMINAL POSTS

- A. Corner posts shall be 3-inch O.D. standard weight galvanized steel with top caps, except when shown differently on plans. Posts shall be set in concrete footings. Fabric shall not be attached to posts until concrete footings are sufficiently cured. Centerline of posts shall be set 12 inches from the facility property line as shown on the plans. Where specified for vinyl coating, the posts shall be powder coated.

- B. Line posts shall be 2-inch O.D. standard weight galvanized steel with top caps, except where shown on plans differently. Where specified for vinyl coating, the posts shall be powder coated.

2.04 FABRIC CONNECTIONS

- A. Fabric shall be attached to corner and terminal posts with 3/16 inch x 3/4 inch tension bars and 7/8 inch beveled steel. Tension band spaced at a maximum of 14 inches on center. Where specified on the plans for vinyl coating, all hardware shall be powder coated.

2.05 RAILS AND DIAGONAL BRACING

- A. If specified, the top, middle, and bottom rail shall be 1½ inch O.D. standard weight pipe fastened to corner and terminal post with malleable rail end cup and 7/8 inch beveled steel brace band. Where specified on plans for vinyl coated fence, rails and bracing shall be powder coated.
- B. Install diagonal bracing midway between the top rail and ground level from the terminal post to the corner post and fasten to post with malleable rail end and 7/8 inch beveled brace bands.
- C. Barbed-wire shall consist of three (3) strands of 12½ gauge zinc-coated wire with 14-gauge 4 point barbs spaced at five (5) inches apart. Furnish barb-wire and supporting arms. Barb-wire and supporting arms shall be zinc-coated.

2.06 GATE FRAMES

- A. Gate frames shall be constructed of tubular members round welded at all corners or assembled with fittings. Steel welds shall be painted with zinc-based paint. Where vinyl coating is called for, welded joints shall be sanded, primed, and repainted with vinyl paint. Where corner fittings are used, gates shall have truss rods of 3/8 inch nominal diameter to prevent sag or twist. Gate leaves shall have vertical intermediate bracing as required, spaced so that members are no more than 8 feet apart. Gate leave 10 feet or over shall have a horizontal brace or one 3/8 inch, diagonal truss rod. When barbed wire top is specified at the end members of the gate, frames shall be extended one foot above the top horizontal member to which 3 strands of barbed wire, uniformly spaced, shall be attached by use of bands, clips, or hook bolts. Gate filler shall be of the same fabric as specified for fence and shall be attached to gate frame at intervals of 14 inches.

2.07 HINGES

- A. Hinges shall have large bearing surfaces for clamping in position. The hinges shall not twist or turn under the action of the gate. The gate shall be capable of being opened and closed easily by one person. All hardware shall be pressed steel. Where specified on plans for vinyl coated fence, the hinges shall be powder coated.

2.08 LATCHES, STOPS AND KEEPERS

- A. Latches, stops and keepers shall be provided for all gates. Latches shall have a plunger bar arranged to engage the center stop, except that for single gates of openings less than 10 feet wide a fork latch may be provided. Latches shall be arranged for locking. Center stops shall consist of a device arranged to be set in

concrete or asphalt and to engage a plunger bar of the latch of double gates. No stop is required for single gates. Keepers shall consist of a mechanical device securing the free end of the gate when in fully open position. All hardware shall be pressed steel. Where specified on the plans for vinyl coated fence, the hardware shall be powder coated.

END OF SECTION

**SECTION 02821
GRASSING**

PART 1 - GENERAL

1.01 APPLICABLE STANDARDS

- A. Conform to Section 700 and other applicable articles of the "Standard Specifications Construction of Transportation Systems", of the Department of Transportation, State of Georgia, dated April 18, 2013. Omit all references to measurement and payment.

1.02 SOIL SAMPLES

- A. The Contractor shall take soil samples from several areas of the site to be grassed and have them analyzed by the Georgia Extension Service. The results of the analysis shall determine the best fertilizer mixture to use on the site.

PART 2 - MATERIALS

2.01 FERTILIZER

- A. Commercial Fertilizer: Fertilizer for lawns shall be a complete fertilizer, the nitrogen content of which shall be derived from either organic or inorganic sources and meeting the following minimum requirements of plant food by weight, unless the soil analysis and report indicates a need for a different fertilizer mixture in which case the recommended mixture shall be furnished and applied. All State and Federal laws relative to fertilizer must be complied with.

10% Nitrogen - 12% Phosphoric Acid - 12% Potash

- B. Ground Limestone: Lime shall be ground dolomitic limestone containing not less than 85% of total carbonates and shall be ground to such fineness that 50% will pass through a 20-mesh sieve. Coarser material will be acceptable, provided the specified rates of application are increased proportionately on the basis of quantities passing the 100-mesh sieve.
- C. Sodium Nitrate shall be a commercial product in dry powder form and shall be delivered in the original, unopened containers each bearing the manufacturer's guaranteed statement of analysis. It shall contain not less than 16% Nitrogen.

2.02 LAWN MATERIALS

- A. Kentucky 31 Fescue (Fescue elatior: var. arundinacea): Seed shall be 98% minimum purity and 85% germination.
- B. Bermuda Grass (Cyanodon Dactylon): Seed shall be 98% minimum purity and 85% germination.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Prepare the seed bed by thoroughly cultivating, discing and hand raking as necessary to produce a smooth even grade free from hollows or other inequalities. Before any seeding is attempted the soil must be in a well pulverized, smooth, friable condition of uniformly fine texture.

3.02 FERTILIZING AND LIMING

- A. Approximately two (2) days prior to the start of seeding operations, apply ground limestone at the rate of 20 pounds per 1000 sq. ft. of lawn area. Either in conjunction with the above operation or immediately afterwards apply the specified Commercial Fertilizer over all lawn areas at the rate of 30 pounds per 1000 sq. ft. of lawn area. Work limestone into the top 6 inches of ground and the fertilizer into the top 2 inches of ground.
- B. When the grass has started to cover well (approximately 4 weeks after sowing seed) apply 1-1/2 pounds of Ammonium Nitrate to all lawn areas and immediately water using a fine spray. At the end of the maintenance period and prior to the final inspection apply 10 pounds of the specified Commercial Fertilizer per 1000 sq. ft. of lawn area and immediately water.

3.03 SEEDING

- A. Before any seeding is attempted the soil must be in a well pulverized, smooth, friable condition of uniformly fine texture. Lawn areas shall be seeded evenly with a mechanical spreader at the rate of 2 lbs. of seed per 1000 sq. ft., 50% in one direction and the remainder sown at right angles to first sowing. The seeded areas shall be lightly raked, rolled with a suitable weight roller and watered with a fine spray.
- B. Fescue planting season shall be as approved by Engineer.
- C. Bermuda Grass seeding shall be planted only between May 1 to September 1.
- D. When grassing is required between curbs and sidewalks, behind sidewalks in areas adjacent to private property, the Engineer may change the type of seeding to that required to match any type of grass which may be planted and growing on the adjacent lawn. No increase in the Contract Sum will be made for this substitution.

3.04 WATERING

- A. Soak soil to a minimum depth of 6 inches immediately after seeding. Do not wash away soil or seed. Keep all surfaces continuously moist thereafter until 30 days after the lawn has been seeded. Use fine spray nozzles only.

3.05 RESPONSIBILITY

- A. Maintenance of grass areas shall consist of watering, weeding, cutting, repair of any erosion and reseeding or resodding as necessary to establish a uniform stand of the specified grasses, and shall continue until final acceptance.

- B. All grassed areas that do not show satisfactory growth within 15 days after sowing shall be re-sown and re-fertilized as directed until a satisfactory blanket is established. Approximately 3 weeks after sowing the last seed, but not before the seed has taken hold and the grass is growing well, apply sulfate of ammonia or sodium nitrate at the rate of 300 pounds to the acre and water immediately. The lawns shall be considered established when they are reasonably free from weed, green in appearance and the specified grass is vigorous and growing well on each square foot of lawn area. Full coverage is required in 60 days.
- C. All grassed areas shall be protected until accepted. All eroded and damaged areas, regardless of cause, shall be immediately repaired and reseeded. Protect lawn areas against traffic.
- D. Grassed areas shall be covered evenly with a loose layer of clean wheat, rye, oats, Seresia Lespedeza or Coastal Bermuda Hay. Two tons of dry mulch shall be applied to each acre seeded. Hay shall be placed during calm weather with no wind.
- E. As soon as the grass becomes established, a final inspection of the work will be made, provided a written request for such inspection is given to the Engineer. Satisfactory coverage is defined as coverage of the areas seeded with grass that is alive and growing, leaving no bare spots larger than one (1) square foot with 98% coverage.
- F. All temporary valves, cutoffs and piping shall be removed by the Contractor at final acceptance of the grassing.

END OF SECTION

**SECTION 03300
GENERAL CONCRETE**

PART 1 - GENERAL

1.01 QUALITY STANDARDS

- A. Any procedure and material operation specified by reference to the following publications shall comply with the requirements of the current specification or standard:

1. American Society for Testing Materials (ASTM):

- A185 Welded Steel Wire Fabric for Concrete Reinforcement.
- A615 Deformed Billet-Steel Bars for Concrete Reinforcement.
- C31 Method of Making and Curing Concrete Compression and Flexure Test Specimens in the Field.
- C33 Specification for Concrete Aggregate.
- C39 Compressive Strength of Molded Concrete Cylinders.
- C94 Specification for Ready-Mixed Concrete.
- C143 Slump of Portland Cement Concrete.
- C150 Portland Cement.
- C172 Sampling Fresh Concrete.
- C192 Making and Curing Concrete Test Specimens in the Laboratory.
- D1751 Preformed Expansion Joint Fillers for Concrete Paving.

2. American Concrete Institute:

- ACI 301 Specification for Structural Concrete for Buildings.
- ACI 305 Recommended Practice for Hot Weather Concreting.
- ACI 318 Building Code Requirements for Reinforced Concrete.

1.02 QUALITY CONTROL

- A. The Contractor shall submit to the Engineer, for review a design mix for each class of concrete listed under CLASSES OF CONCRETE, prior to placing any concrete.
- B. Verification tests of design mixes and aggregates are required by the Engineer. Verification test specimens shall be made in accordance with ASTM C39 by an Independent Test Laboratory. Compressive strength shown by verification tests shall be at least fifteen percent in excess of the strengths listed under CLASSES OF CON-

CRETE. The Independent Testing Laboratory shall report the test results to the Engineer, in writing and shall note any failure to meet the specification.

- C. Verification tests of design mixes made not more than one year prior to the date of submittal will be acceptable provided they were made from materials identical to those to be used in the project.
- D. Mill Test: Conducted in accordance with ASTM A615 recommendations on each 15 tons, or less reinforcing shipped to the job. Two (2) copies of test to be sent to the Engineer.
- E. Inspection and Testing of Concrete:
 - 1. The cost of slump tests and sampling, molding, storing, materials, transporting concrete test specimens shall be paid by the Contractor. The laboratory or inspection agency shall be selected by the Owner. Costs of all laboratory testing services required because of failure to meet the requirements of these specifications shall be paid by the Contractor.
 - 2. One set of four (4) acceptance cylinders shall be prepared for each day's placing of each strength of concrete and if more than 50 cubic yards of concrete is placed in any day, there shall be an additional set of cylinders prepared for each 50 cubic yards placed or for any fraction thereof. One cylinder shall be broken at seven days and two at twenty-eight days, with one cylinder held in reserve.
 - 3. Responsibilities in Inspection:
 - a. Laboratory's Duties
 - 1. The reception and marking of specimens in the laboratory, laboratory curing, preparation for breaking and testing of cylinders shall be the responsibility of the laboratory and shall be performed by qualified laboratory personnel, observing all requirements of applicable ASTM Standards. Compression test specimens shall be tested in accordance with ASTM C39.
 - 2. Prior to the commencement of concrete work, the laboratory shall provide initial instruction in the performance of sampling and testing duties for an employee designated by the Contractor and shall provide him with copies of all ASTM Standards pertinent to his duties.
 - b. Contractor's Duties:
 - 1. The Contractor shall deliver to the laboratory all materials to be used in required testing. He shall supply wheelbarrows, shovels, mixing boards, shaded workspace and similar equipment required for molding test cylinders. He shall provide stable, insulated storage boxes, equipped with thermostatically controlled heat, for storage of cylinders in the first 24 hours after molding.
 - 2. He shall designate an employee, who alone shall perform all operations of sampling concrete, molding test specimens, protecting

test specimens for the first 24 hours after molding, and packing and shipping of test specimens. The employee shall make a record of a slump test in connection with each truckload of concrete. The designated employee shall receive initial instruction in the performance of his sampling and testing duties from a representative of the testing laboratory and shall have available copies of all ASTM Standards pertinent to his duties. Sampling shall conform to ASTM C172. Slump tests shall conform to ASTM C143. Compression test specimens shall be made and cured in accordance with ASTM C31.

3. Each set of test cylinders shipped to the laboratory shall be accompanied by a report giving information as to location in the structure of concrete sampled, time and date of sampling, air temperature, slump, class designated nominal strength, air content if applicable, temperature of concrete, truck number, and time batched. Each report shall be signed by the employee making the test and by the Contractor or his representative, certifying that the test specimens have been made by the one designated, fully instructed employee and have been made in accordance with applicable standard specifications.
4. Should any concrete fail to meet the specified strength, have a slump in excess of that required by the design mix for each class of concrete listed under CLASSES OF CONCRETE, or result in voids, honeycombs or otherwise fail to meet the requirements, the Engineer may order the concrete removed, further tests made, or other remedial measures taken, all at the Contractor's expense.

1.03 SHOP DRAWINGS

- A. After making his check the Contractor shall submit to the Engineer one (1) blue line copy of each of placing plans, bending details and bar lists covering all reinforcing steel.
- B. Full information for checking and for proper installation without reference to other drawings shall be included. At splices the amount of lap shall be shown. Location and arrangement of accessories shall be clearly shown. Elevations shall be drawn for all reinforced masonry and reinforced concrete walls to a scale no smaller than 1/4 inch = 1 foot.
- C. Work shall not proceed before the Contractor has received shop drawings approved by the Engineer. The Contractor shall be responsible for the conformation of all typical and special reinforcing steel details.
- D. Engineer's review is for conformance to the design concept and contract documents. Markings or comments shall not be construed as relieving the Contractor from compliance with the project plans and specifications, nor departures therefrom. The Contractor remains responsible for details and accuracy, for selecting fabrication processes, for techniques of assembly, and for performing his work in a safe manner.
- E. Proposed construction joint shall be clearly indicated on shop drawings and subject to approval of the Engineer.

1.04 INSPECTION

- A. The Contractor shall give the Engineer 24 hours advance notice before starting to place concrete in any portion of the structure to permit observation. An authorization of the Engineer shall be secured before concrete is placed. Any concrete placed in violation to this provision shall be replaced by new concrete if required by the Engineer.
- B. Prior to notification of the Engineer, the Superintendent shall personally inspect the work and verify that it is ready for observation.
- C. At the time of observation, all reinforcing in the area where concrete is to be poured shall be in place, tied and ready for the placement of concrete. All anchors, sleeves, inserts, etc., shall be securely held in position.

1.05 STORAGE

- A. Reinforcing steel delivered to the job and not immediately placed in forms shall be placed in racks or other supports at least eighteen (18) inches above ground.

PART 2 - MATERIALS

2.01 CEMENT

- A. Portland cement shall conform to ASTM C150, Type I.

2.02 AGGREGATES

- A. Aggregates for standard weight concrete shall conform to ASTM C33, maximum size: 3/4 inch.

2.03 WATER

- A. Mixing water shall be potable.

2.04 REINFORCING STEEL

- A. Reinforcing bars shall be American manufactured conforming to the requirements of ASTM A615 "Deformed Billet Steel Bars for Concrete Reinforcement", Grade 60.
- B. Welded wire-fabric or cold-drawn wire for concrete reinforcement shall be of American manufacture and shall conform to the requirements of the ASTM A185 "Welded Steel Fabric for Concrete Reinforcement".
- C. Accessories shall conform to the requirements of C.R.S.I. Manual.

2.05 READY MIXED STRUCTURAL CONCRETE:

- A. Ready mix concrete shall be mixed and delivered in accordance with these specifications and requirements set forth in ASTM C94. In addition, these following conditions must be met:
 - 1. Concrete shall be normal weight with an ultimate compressive strength at 28 days, and slump as follows:

2. Air entrained concrete shall be used for all structural concrete with the air content not less than 3 percent and no more than 5 percent.

B. Classes of Concrete:

Class A f'c = 3000 psi, Slump 4 inches +/- 1 inch
Class AA f'c = 4000 psi, Slump 3 inches +/- 1 inch
Class B f'c = 5000 psi, Slump 5 inches +/- 1 inch

2.06 EXPANSION JOINT MATERIAL

- A. Expansion joint material at slabs on grade shall be premolded asphalt saturated cellulose fiber or mineral strips conforming to ASTM D1751.

2.07 WALL TIES

- A. Ties shall be made with break back ends or other means of removing the tie end to a depth of at least 1 inch from the concrete surface after the forms are removed.

2.08 LIQUID FORM SEALER

- A. Form sealer shall be a standard product compatible with the finish required for exposed concrete and shall contain no paraffin oil or mineral oil.

PART 3 – EXECUTION

3.01 FORMWORK

- A. Forms shall conform to the shapes, lines and dimensions of the members as indicated, and shall be substantial and sufficiently tight to prevent leakage of mortar. They shall be braced or tied together so as to maintain position and shape.
- B. Formwork shall be observed by the Engineer before pouring concrete. Before placing the reinforcement, surfaces of wood forms in contact with the concrete, unless lined, shall receive a thorough coating of form sealer. The Engineer shall have the right to reject any forms that do not appear to him to be sufficient as to alignment and of producing the required finished surface. Should misalignment of forms or screed, excessive deflection of forms or displacement of reinforcing occur during concrete placing, corrective measures shall be immediately made to the extent, if necessary, that placing operations shall be stopped and concrete removed from within forms. The surfaces to required dimensions and cross section. Exposed lines and surfaces shall not vary from dimensions shown on plans by more than 1/4 inch in twenty feet.
- C. Forms may be constructed of wood or metal. Earth forms for footings may be permitted if local conditions are favorable and approved by the Engineer. Form work for exposed concrete shall be form grade plywood.
- D. Studs, waler, and ties shall be so spaced that the load of wet concrete will not stress ties beyond the printed working load recommended by the manufacturer not cause spans of form material to deflect from a true surface.

- E. The Contractor shall maintain a continuous check upon formwork during the placing of concrete. An instrument check shall be periodically made, or "Tattle Tail" rods or other devices shall be used to detect any settlement in forms.
- F. Conduits in Concrete: Conduits shall not displace reinforcing steel from its intended position, nor impair the strength of the structure.
- G. The Contractor shall assume all responsibility for removal of formwork. Elevated concrete slabs shall attain 70% of the specified ultimate strength before removing the forms. After removing forms, slabs shall be reshored at mid-span and at all points under shores supporting forms for the work above. No floor shall be loaded in excess of the live load for which designed unless adequate shores are placed beneath members supporting the concrete of load.

3.02 PLACING REINFORCING STEEL

- A. Reinforcement shall be shop fabricated, accurately positioned, and secured with not less than 16 gauge annealed wire or suitable clips.
- B. No bars, partially embedded in concrete shall be field bent, unless noted otherwise.
- C. Reinforcing bars shall be accurately placed and secured in position by approved chairs, spacers, or ties to maintain the position of the reinforcing steel prior to and during placing of concrete.
- D. Reinforcing steel support chairs and bolsters for use in concrete to be exposed shall have galvanized steel leg.
- E. No splices shall be made, except as shown on approved Shop Drawings or approved in writing by the Engineer.
- F. The placement of reinforcement shall be observed by the Engineer before pouring of concrete. Should there be any delay in the work, reinforcement previously placed shall be reinspected and cleaned if necessary before concrete placement is resumed.
- G. Metal reinforcement shall be protected by concrete cover. Where not otherwise shown, the thickness of concrete over the reinforcement shall be as follows:

Footings	3" clear sides and bottom
Slabs	3/4" clear, top and bottom
Beams	2" clear, all around
Walls	2" clear, both faces
Columns & Piers	2" clear
- H. All splicing or reinforcement not shown shall be approved by the Engineer. Splices shall not be made at a point of maximum stress and shall provide sufficient lap to transfer the stress between bars by bond. Hook and bending details, column tie arrangements, etc., shall be as shown by the S.R.A.I. Manual or the ACI Detail Engineering Manual.
- I. Wire mesh reinforcing shall be placed one inch from top of concrete slabs on ground. Lap all joints 12 inches and extend mesh to within 1 inch of sides and ends of slabs.

3.03 CONCRETE MIXING AND PLACING

- A. Ready-mix concrete shall conform to ASTM C94. Not more than one hour shall elapse between the time mixing water is added to the batch and the concrete is poured. No water shall be added on the job.
- B. No concrete shall be placed until all embedded items and reinforcing have been placed in the forms and observed by the Engineer. At least 24-hour notice shall be given the Engineer of an impending pour, so that he may observe the work, prior to placing.
- C. Concrete shall be conveyed from the mixer to the place of final deposit by methods that will prevent segregation or loss of materials.
- D. Concrete shall be deposited in its final position to avoid segregations and separation do to rehandling or flowing. The placing shall be carried on at such a rate that concrete is at all times plastic and flows readily into the spaces between bars. When placing is once started, it shall be carried on as a continuous operation, until placement of that section is completed.
- E. Concrete shall be worked into and around bars and embedded items with spades, rods, trowels and vibrators, so as to produce a solid homogeneous mass, free of voids, pockets, or honeycombs.
- F. Construction joints shall be installed and located as indicated. Where a joint occurs, the surface of the concrete shall be thoroughly cleaned and all laitance removed and shall be left rough or mechanically roughened, thoroughly wetted and slushed with a coat of neat cement grout immediately before placement of new concrete.
- G. All embedded items, including anchor bolts and dowels, shall be in place, preset and held in position, before any concrete is placed.
- H. No concreting shall be performed when ambient temperatures are below 40°F or if the temperature is predicted by the local U.S. Weather Bureau will fall below 40°F within 24 hours after the time of installation.
- I. No concrete shall be installed against frozen ground. All foundation cavities and slab areas that have frozen, shall be thoroughly clean of all loose earth prior to pouring concrete.
- J. All newly poured concrete shall be protected from freezing or near freezing weather during the cure period.
- K. Hot weather precautions shall be taken whenever the maximum air temperature exceeds 80°F during the day. Hot weather concreting shall be performed in accordance with ACI 305.

3.04 EXPANSION/CONTROL JOINT INSTALLATION

- A. Expansion joints shall be placed a maximum of 20 ft. intervals and at all intersections with steps, curbs other walks or abutting structures. Joints shall extend from the surface to the subgrade at right angles to the sidewalk.

- B. Expansion joint filler shall be 1/2 inch thick and as wide as the full width and depth of the sidewalk. All expansion joints shall be filled with semi-rigid epoxy, specifically manufactured for the sealing of control joints in concrete slab construction, to create a watertight slab.
- C. Control joints (tooled or saw-cut) shall be placed at no less than 12 and no more than 15 ft. intervals, in a square grid, throughout the full length and width of the concrete slab. All control joints shall be filled with semi-rigid epoxy, specifically manufactured for the sealing of control joints in concrete slab construction, to create a watertight slab.

3.05 ANCHORAGE

- A. Slots, inserts, and connections elements for anchoring items to concrete shall be built into forms before placing concrete.

3.06 SLABS ON GRADE

- A. Concrete shall be compacted, screeded to grade, and prepared for the specified finish. Slabs shall be placed in panels in alternate checkerboard pattern or in alternate lanes divided into panels. Each panel shall be approximately square terminated by slab joints.
- B. Contraction joints shall be true to line 1/8 inch wide, and of depth equal to approximately 1/4 of the slab thickness. Joints shall be sawed or formed.

3.07 CURING

- A. Provisions shall be made for maintaining concrete in a moist condition for at least 10 days after the placement of the concrete, or by one of the following methods:
 - 1. Spraying with water or ponding.
 - 2. Using moisture retaining covers.
 - 3. Concrete curing compound, W.R. Meadows CS-309 or Guardian Chemical Co., Master Builders or Triple-Cure by Cobra Chemicals.
- B. The spraying water shall be applied on unformed surfaces within one hour after the forms are stripped and the spraying shall be continuous. The moisture retaining cover shall be applied on unformed surfaces immediately after the concrete is finished. If there is any delay, the concrete shall be kept moist until the application is made. If the surfaces are formed, the forms shall be removed, and the concrete sprayed lightly with water before the cover is applied.
- C. When concrete surfaces are to receive applied finishes of materials, all curing compounds shall be checked for compatibility with other material to be applied to the concrete surfaces before application.

3.08 CONCRETE FINISHES

- A. All poured joints, voids, honeycombs and other imperfections shall be patched within the same working day that forms are removed.

B. Troweled Finish:

1. Troweled finish shall be applied to the surface of all floors unless ceramic tile, quarry tile or pavers are called for on finish schedule.
2. Floor slabs shall be screened to an even surface by the use of straight-edge and screeding strips accurately set to the proper grade. The concrete shall be floated with a wood float in a manner which will compact it and produce a surface free from depressions or inequalities of any kind. Floors shall be level with a tolerance of 1/8 inch in 10 feet except where drains are indicated. After the concrete has hardened sufficiently to prevent fine materials from working to the top and has been allowed to stand until all water sheen has disappeared, it shall be steel troweled. Final troweling shall be done after the concrete is hard enough that no mortar accumulates on the trowel and a ringing sound is produced as the trowel is drawn over the surface. The drying of the surface moisture before troweling shall proceed naturally and shall not be hastened by the dusting on of dry sand or cement.

C. Non-slip Finish: All exterior platforms and step treads shall be made non-slippery by application at not less than 1/4 lb. per sq. ft. of aluminum oxide or emery aggregate graded from particles retained on a #50 mesh screen to particles passing an 1/8 inch screen placed during the finishing process. Abrasive aggregate shall be sprinkled by hand as soon as the freshly placed cement will support the weight of workmen and floated into the surface.

D. Unfinished Slabs: Depressed slab areas to receive ceramic quarry tile or pavers shall be finished to remove all laitance and to leave a slightly roughened, surface to insure bond. The surface of the slab shall not vary in any direction more than 1/8 inch when tested with a ten-foot straight edge. The straight edge shall be lapped one half its length as the test is being made.

3.09 CONCRETE FLOOR HARDENER

- A. All concrete floor slabs shall be cured with concrete floor hardener, "Clear Bond", as manufactured by Guardian Chemical, "Triple-Cure" by Cobra Chemicals, or "Sealtight Cs-309 by W.R. Meadows. The floor hardener shall be applied in strict accordance with the manufacturer's recommendations.
- B. Walks shall be tooled, full 1 inch deep into separate slabs as indicated. Surface edges of each slab shall be rounded to approximately 1/4 inch radius.
- C. Final finish shall be a medium or light broom finish and all tool marks completely removed.

END OF SECTION

**SECTION 03301
CONCRETE FOR BUILDINGS**

PART 1 - GENERAL

1.01 Codes with the provisions of the following codes, specifications and standards, except as otherwise shown or specified:

1. ACI 301 "Specifications for Structural Concrete for Buildings."
2. ACI 311 "Recommended Practice for Concrete Inspections."
3. ACI 318 "Building Code Requirements for the Reinforced Concrete."
4. ACI 347 "Recommended Practice for Concrete Form-work."
5. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete."
6. Concrete Reinforcing Steel Institute, "Manual of Standard Practice."

1.02 SUBMITTALS

- A. Laboratory test reports for concrete materials and mix design.
- B. Certificate of design conformance.

PART 2 - PRODUCTS

2.01 AGGREGATE

- A. Coarse Aggregate: ASTM designation C33. Maximum nominal coarse aggregate shall be ½" maximum size for concrete blockfill and 1" maximum size for other concrete.
- B. Fine Aggregate: ASTM designation C3 washed sand.

2.02 PORTLAND CEMENT

- A. Federal Specification SS-C-192, Type 1 or ASTM C150-72 Type 1.

2.03 CURING MATERIALS

- A. Membrane-forming curing compounds: Non-yellowing acrylic, resin-base or chlorinated rubber-base type conforming to Federal Specifications TT-C-800 non-pigmented.

2.04 AIR-ENTRAINING ADMIXTURE

- A. ASTM C260

2.05 REINFORCEMENT

- A. Bars: Conforming to ASTM designation A615, Grade 60.

B. Mesh: ASTM A185. Welded steel wire fabric.

2.06 WATER

A. Water shall be potable and free from deleterious substances.

2.07 COLD JOINTS

A. Burke keyed cold joint form or equal.

2.08 EXPANSION JOINTS

A. ASTM D1751 Resilient, non-extruding, asphalt impregnated fiberboard.

PART 3 - EXECUTION

3.01 FORMWORK

- A. Forms shall be designed, constructed and maintained to ensure that after removal of forms the finished concrete members will have true surfaces free of waviness or bulges, conforming accurately to the indicated shapes, dimensions, line elevations and positions. Form surfaces that will be in contact with concrete shall be thoroughly cleaned before each use. Forms shall be coated with a chemical form release; non-oil, non-staining.
- B. Form ties shall be factory fabricated, removable or snap-off metal ties of design that will not allow form deflection and will not spill concrete upon removal.
- C. Exposed external corners shall be beveled or chamfered by moldings placed in the forms.

3.02 REINFORCEMENT

- A. Reinforcement shall be fabricated to shapes and dimensions shown and shall be placed where indicated. Reinforcement shall be free of loose or flaky rust and mill scale, or coating including ice and any other substance that would reduce or destroy the bond.
- B. Reinforcement detailing and placement including concrete protection for steel reinforcement shall conform to ACI Standard 318 and 315.

3.03 JOINTS

- A. Pre-molded expansion joint filler: At expansion joints in concrete slabs to be exposed, pre-molded expansion joint filler strips shall be installed at the proper level.
- B. Construction joints other than slabs on grade: Concrete shall be placed continuously so that the unit will be monolithic in construction. Fresh concrete may be placed against adjoining units provided the set concrete is sufficiently hard not to be injured thereby. Joints not indicated shall be made and located to least impair strength and appearance of the structure. Construction joints, if required, shall be located near the midpoint as spans for slabs or beams.

3.04 CONCRETE MIX DESIGNS

- A. Concrete mix shall be designed for a 3000 psi compressive strength at 28 days.
- B. Mix proportions shall be determined in compliance with ACI Standard 318.

3.05 SLUMP LIMITS

- 1. 3" maximum slump for slabs and walks.
- 2. 4" minimum slump for curbs and footings.

3.06 BATCHING AND MIXING

- A. Concrete of the ingredients and design mixes shall be measured, batched and mixed at the plant in conformance with ASTM designation C94.

3.07 PREPARATION FOR PLACING CONCRETE

- A. Water shall be removed from excavations before placing concrete. Hardened concrete, debris and foreign materials shall be removed from interior of forms and from inner surfaces of mixing and conveying equipment. Reinforcement shall be secured in position.

3.08 PLACING CONCRETE

- A. Concrete shall be handled from mixer to transport vehicle to place of final deposit in a continuous manner, as rapidly as practicable, without segregation or loss of ingredient until the approved unit of operation is completed.

3.09 DEPOSITING IN COLD OR HOT WEATHER

- A. Concrete, when deposited shall have a temperature not below 55°F and not above 90°F. In freezing weather suitable means shall be provided for maintaining concrete after depositing at a temperature not lower than 70°F for 3 days, or 50°F for 5 days after placing, except when high early strength Portland cement or concrete is used temperature must be maintained at not less than 70°F for 2 days or at 50°F for 3 days.
- B. Cooling of concrete to outside temperature shall not be at a rate faster than one degree each hour per first day and two degrees each hour thereafter until outside temperature is reached. Methods of heating material and protecting concrete shall be approved by Engineer. Salt, chemicals or other foreign materials shall not be mixed with concrete for the purpose of preventing freezing.
- C. Deposit in hot weather (90° and above), take special care in placing concrete during hot weather. Forms must be thoroughly wetted just before concrete is placed and exposed surfaces of concrete shall be kept continually damp by sprinkling for 7 days.

3.10 COMPACTION

- A. Immediately after placing, each layer of concrete shall be compacted by internal concrete vibrator supplemented by hand-spading, rodding and tamping. Tapping or other external vibration for forms will not be permitted.

3.11 BONDING

- A. Before depositing new concrete on concrete that has set, the surfaces of the set concrete shall be thoroughly cleaned to expose the coarse aggregate and be free of laitance, coatings, foreign matter and loose particles. Forms shall be retightened. The cleaned surfaces may be moist but shall be without free water when concrete is placed.

3.12 CURING

- A. Concrete shall be protected against moisture loss, rapid temperature change, mechanical injury from rain or flowing water for a period of 7 days. Concrete shall be maintained in a moist condition at temperatures above 50°F throughout the specified curing period. Concrete shall be protected from rapid temperature change and rapid drying for the first 24 hours following the removal of temperature protection. Curing shall be accomplished by the following methods:
 1. Impervious - sheet curing - All surfaces shall be thoroughly wetted with a fine spray of water and be completely covered with water proof paper, or polyethylene sheeting, or with polyethylene coated burlap having the burlap thoroughly water saturated before placing.
 2. Membrane forming compound curing conforming to ASTM C3009 - The compound shall be applied on damp surfaces as soon as the moisture film has disappeared. The curing compound shall be applied in a two coat, continuous operation at a coverage of not more than 400 square feet per gallon for each coat. Membrane curing compound shall not be used on surfaces that are to receive any subsequent treatment that depends on adhesion or bonding to the concrete. Non-residual may be used on approval.

3.13 REMOVAL OF FORMS

- A. Forms shall be removed in a manner to completely ensure the safety of the structure. Forms may be removed after 24 hours, provided the concrete is sufficiently hard not to damage thereby.

3.14 FINISHES AND PATCHING OF CONCRETE OTHER THAN FLOOR SLABS

- A. Within 12 hours after forms are removed, surface defects shall be remedied as specified herein. Temperature of concrete, ambient air and mortar during remedial work including curing shall be above 50°F. Fins and loose material shall be removed. Honeycomb, aggregate pockets, voids over ½" in diameter and holes left by the rods or bolts shall cut out to solid concrete, thoroughly wetted, brush coated with neat cement grout and filled mortar. Mortar shall be a stiff mix of 1 part blended Portland and white cements to 2 parts fine aggregate passing the No. 16 sieve and a minimum amount of water. When dry, the color of the mortar shall approximately match the adjoining concrete color. Mortar shall be thoroughly compacted in place.

- B. Hand rubbed finish shall be used on 45° sloped exposed concrete.

3.15 FINISHING CONCRETE SLAB SURFACES

- A. Trowel finish - Immediately after slab is placed, screed top surface of concrete slab, tamp concrete with tamping tools to bring grout to surface. Darby to produce true level. Squeeze off excess water and laitance. Test surface with 10 foot straight edge so that depressions do not exceed 1/4" in center of span of straight edge in any direction. Machine float slabs to proper elevations and allow to stand until all water sheen has disappeared before troweling. Delay finish troweling until concrete is so hard that no mortar accumulates on a trowel and ringing sound is produced as the surface is finished with the trowel. Do not dust cement finishing. Finish surfaces neatly around columns, walls, etc. When finished, slab depression shall not exceed 1/4" in the length of a 10 foot straight edge in any direction.
- B. Broom finish slabs - Walks and paving - Immediately after slab is placed, screed top surface of slab; tamp concrete with jitterbug, darby or wood float to produce true level or sloped smooth finish. After initial set, groom with stiff fiber broom to remove laitance and smooth spots. Repeat brooming the following day. Remove excess material and protect.

3.16 CLEANUP

- A. Upon completion of the work, forms equipment protection covering and any rubbish resulting therefrom shall be removed from the premises. Finished concrete surfaces shall be left in a clean and perfect condition, satisfactory of the Engineer.

END OF SECTION

SECTION 09901 MANHOLE LINER

PART 1 - GENERAL

1.01 DESCRIPTION

The work required for this section should include all work necessary to complete the lining of the specified manholes in vertical feet and width. The liner system should be monolithic once installed and should be impervious to infiltration.

1.02 SUBMITTALS

- A. All materials and procedures required to establish compliance with the specifications shall be submitted to the owner/engineer for review/approval. Submittals shall include at least the following:
1. Technical Data Sheet on each product used.
 2. Material Safety Data Sheet (MSDS) for each product used.
 3. ASTM References.
 4. CIGMAT Evaluation.
 5. Descriptive literature, bulletins and or catalogs of materials.
 6. Work procedures including flow diversion plan, method of repair, etc.
 7. Material and method for repair of leaks or cracks in manholes.
 8. Final installation report on completed manholes.

1.03 WARRANTY

- A. Liner system should be warranted for a time period of 10 years or greater. Warranted item must be repaired within 60 days or less at no cost to the owner. It is understood that the normal sanitary sewer composition includes high concentrations of Hydrogen Sulfide and that the proposed liner system is able to withstand and prevent damage from it and all typical substances found in the City of Folkston's waste water.

1.04 QUALITY ASSURANCE

- A. The manufacturer and/or applicator of the total liner system of manholes shall be a company that specializes in the design, manufacture or installation of corrosion protection systems for manholes. Applicator shall be completely trained in leak repair, surface preparation and corrosion materials application on manholes. Corrosion materials/products shall be suitable for installation in a severe hydrogen sulfide environment without any deterioration to the liner.

- B. The applicator shall be trained and certified by the manufacturer for the handling, mixing, application and inspection of the liner system as described herein.
- C. To ensure total unit responsibility, all materials and installation thereof shall be furnished and coordinated with/by one supplier/applicator who turnkeys the work and assumes full responsibility for the entire operation.

PART 2 – PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. The materials to be utilized in the lining of manholes shall be designed and manufactured to withstand the severe effects of hydrogen sulfide in a wastewater environment. Manufacturer of corrosion protection products shall have long proven experience in the production of the lining products utilized and shall have satisfactory installation record
- B. Equipment for installation of lining materials shall be high quality grade and be as recommended by the manufacturer.
- C. The lining system to be utilized for manhole structures shall be a multi-component stress skin panel liner system as described below:

1. Liner

<u>Installation</u>	<u>Liner</u>
Moisture Barrier	Modified Polymer
Surfacer	Polyurethane/Polymeric Blend Foam
Final Corrosion Barrier	Modified Polymer

- 2. Modified polymer shall be sprayable, solvent free, two-component polymeric, moisture/chemical barrier specifically developed for the corrosive wastewater environment.

TYPICAL CHEMICAL ANALYSIS

“A” Component

Viscosity, 77° F, cps., ASTM D-1638	450
Physical State	Liquid
Color	Clear to amber
Hygroscopicity	Reacts with water

"B" Component	
Viscosity, 77° F, cps., ASTM D-1638	500
Physical State	Liquid
Color	Flamingo Pink
Non-Volatile	100%

Reaction Profile (100 grams, 175° F sample)	
Gel Time, seconds	10
Tack Free Time, seconds	20
Cure Time, seconds	90

Processing	
A System / B System, volume ratio	1.00 / 1.00

Typical Physical Properties	
Tensile Strength, PSI	>3600
Elongation, %	>300
Tear Strength, PLI	>5000
Shore A Hardness	96
100% Modulus, PSI	>2500

3. Polyurethane Rigid Structure Foam, low viscosity two-component, containing flame retardants.

TYPICAL CHEMICAL ANALYSIS

"A" Component	
Viscosity, 77° F, cps., ASTM D-1638	200
Physical State	Liquid
Color	Dark Brown
Hygroscopicity	Reacts with water and evolves CO2 gas

"B" Component	
Viscosity, 77° F, cps.,	ASTM D-1638 660
Physical State	Liquid
Color	Transparent Dark
Hygroscopicity	Absorbs water rapidly thus, changing ratio

Reaction Profile (100 grams, 77° F sample)	
Cream Time, seconds	1-4
Tack Free time, seconds	5-8
Rise Time, seconds	6-10

Processing
A System / B System, volume ratio 1.00 / 1.00

Typical Physical Properties
Density, nominal, core, lbs/ft³ ASTM D-1622 @ 74° F 4-10
Compression Strength, ASTM D-1621 @74° F parallel rise; PSI 90-150
Closed Cell Content, % - ASTM 1940 @ 74° F Over 95
Shear Strength, PSI - ASTM C-273 @ 74° F 225-250

4. Total thickness of multi-component stress panel liner shall be a minimum of 500 mils.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Applicator shall take appropriate action to comply with all local, state and federal regulations including those set forth by OSHA, EPA, the Owner and any other applicable authorities.
- B. Prior to conducting any work, perform inspection of structure to determine need for protection against hazardous gases or oxygen depleted atmosphere and the need for flow control or flow Diversion.
- C. Submit plan for flow control or bypass to owner/engineer for approval prior to conducting the work.
- D. New Portland cement structures shall have endured a minimum of 28 days since manufacture prior to commencing installation of the liner system.

3.02 SURFACE PREPARATION

- A. Conduct surface preparation program to include monitoring of atmosphere for hydrogen sulfide, methane, low oxygen or other gases, approved flow control equipment, and surface preparation equipment.
- B. Surface preparation methods may include high pressure water cleaning, hydro blasting, abrasive blasting, grinding, detergent water cleaning and shall be suited to provide a surface compatible for installation of the liner system.

- C. Surface preparation method shall produce a cleaned, abraded and sound surface with no evidence of laitance, loose concrete, brick or mortar, contaminants or debris, and shall display a surface profile suitable for application of liner system.
- D. After completion of surface preparation, perform the seven-point check list, which is the inspection for:
 - 1. Leaks
 - 2. Cracks
 - 3. Holes
 - 4. Exposed Rebar
 - 5. Ring and Cover condition
 - 6. Invert Condition
 - 7. Inlet and Outlet Pipe Condition
- E. After the defects in the structure are identified, repair all leaks with a chemical or hydraulic sealant designed for use in field sealing of ground water. Severe cracks shall be repaired with a urethane based chemical sealant. Product to be utilized shall be as approved by owner/engineer prior to installation. Repairs to exposed rebar, defective pipe penetrations or inverts, etc. shall be repaired utilizing non-shrink grout or approved alternative method.

3.03 MATERIAL INSTALLATION

- A. Application procedures shall conform to recommendations of the manufacturer, including materials handling, mixing, environmental controls during application, safety and spray equipment.
- B. Spray equipment shall be specifically designed to accurately ratio and apply the liner system.
- C. Application of multi-component liner system shall be in strict accordance with manufacturer's recommendation. Final installation shall be a minimum of 500 mils. A permanent identification and date of work performed shall be affixed to the structure in a readily visible location.
- D. Provide final written report to owner/engineer detailing the location, date of report, and description of repair.

3.04 INSPECTION

- A. Final liner system shall be completely free of pinholes or voids. Liner thickness shall be the minimum value as described herein.
- B. Visual inspection shall be made by the Owner/Engineer. Any deficiencies in the finished liner system shall be marked and repaired according to the procedures set forth by Manufacturer.

- C. The sewer system may be returned to full operational service as soon as the final inspection has taken place.

END OF SECTION

**SECTION 15100
VALVES**

PART 1 - GENERAL

1.01 APPLICABLE STANDARDS

- A. American Waterworks Association (AWWA):
 - C-500 Gate Valves-3" through 48" for Water and Other Liquids
- B. American Society for Testing and Materials (ASTM):
 - A48 Gray Iron Casting
 - A240 Chromium and Chromium-Nickle Stainless Steel Plate Sheet, and Strip for Fusion-Welded Unfired Pressure Vessels
 - A307 Low Carbon Steel Externally and Internally Threaded Standard Fasteners
- C. American National Standards Institute (ANSI):
 - B18.2 Square and Hex-Head Bolts and Screws

1.02 DESCRIPTION

- A. All valves of the same type shall be from a single manufacturer. Parts for valves of the same type and size shall be interchangeable. Spare parts shall be furnished where required in the payment items. Special tools required for repacking or disassembling valves shall be provided.
- B. All valves shall open left (counter-clockwise)

1.03 SUBMITTALS

- A. The Contractor shall prepare and submit for approval, six (6) copies of complete detailed drawings of all valves.

PART 2 - PRODUCTS

2.01 VALVES

- A. All valves 2" in diameter and smaller shall be constructed of brass or bronze except that the hand wheel which shall be of malleable iron construction with screwed ends. All valves 2-1/2" in diameter and larger shall have flanged ends for interior service and mechanical joints for buried service unless otherwise approved. They shall be iron body, bronze mounted, except that in the smaller sizes the valves may be all bronze.
- B. Gate Valves:
 - 1. Gate valves smaller than three inches shall meet the requirements of Fed. Spec. WW-V-54, Class A, 125 pounds.

2. Gate valves three inches and larger shall have nonrising stems and shall meet the requirements of AWWA Standard C-500. Valves for lighter pressures than the AWWA Standard shall meet the requirements of the above specifications except that the requirements for metal thickness and strengths and structural designs shall be adjusted as required to meet hydrostatic test pressures not less than 150 psi.
 3. All gate valves shall have standard stuffing box seals. Bonnet bolts, studs and nuts shall be cadmium plated. Seating devices shall be bronze to iron or bronze to bronze. The glands shall be bronze or bronze bushed. Gland bolts and nuts shall be bronze.
 4. All gate valves 2-1/2 inches in diameter and larger shall be of the double disc type. All gate valves two inches in diameter and smaller shall be of the double disc or the solid wedge type.
 5. Valves to have two inches square operating nut, with the exception that gate valves in altitude valves pits shall have hand wheels.
 6. Valves buried in ground or located in vaults or structures shall have suitable extensions for socket operation with top of operating nut located six blow finished grades.
- C. Check Valves:
1. Check valves 2" through 24" shall be iron body, bronze mounted swing check valves meeting the requirements of AWWA Standard C508-76.
 2. The check valve shall be metal to metal or composite to metal seat construction with flange ends or screw and coupled ends.
- D. Altitude Valves:
1. Altitude valves shall have bodies and bonnets of cast iron, or semi-steel with Bronze trim unless otherwise noted on the drawings. They shall be of the differential single acting type as designated on the drawings, and in general shall perform the service of maintaining the liquid level of the storage facility(s) to which they are attached within a 3" to 12" variation.
 2. The valve must be cushioned by air or water in opening and closing to prevent hammer and shock. A regulating device shall be provided to adjust the speed of valve closing.
 3. All altitude valves furnished for use on this project shall be equipped for showing at all times the position of the valve. Said altitude valves shall be of the size specified on the drawings and suitable for the use intended.
 4. The Contractor shall supply the services of a qualified manufacturer's representative to check and calibrate each altitude valve installation for proper working pressure and sequence.

E. Air Release Valves

1. Air release valve shall have all bronze body and bonnet. They shall be the direct acting type.
2. Valves shall be hydrostatically tested to at least 150 psi.
3. The valve shall have stainless steel floats and an internal coating with rust inhibitors.

F. Automatic Control Valves

1. Automatic control valves shall be diaphragm actuated. Valve seat design should readily handle low flow and high differential flow, without enhancement devices.
2. Stainless steel main valve body stem shall be guided top and bottom. The ductile iron valve body shall be rated at 250 psi for class 150 flanges; 640 psi for class 300 flanges; and 640 psi for threaded connections.
3. Ductile iron body and body parts shall be ASTM A536 – epoxy coated. Main valve stem and pilot stems shall be AISI 303 stainless. Diaphragm shall be nylon reinforced Buna – N. Pilot bodies, seat ring and Y-strainer shall be B62 cast bronze. Studs, nuts, plugs and stems should be non-rusting.
4. Speed controls and isolation cocks shall be standard and shall be brass. All tubing shall be stainless, and fittings can be a combination of brass and stainless. All valves shall have visual indicators and shall have up-stream and down-stream isolated pressure gauge ports in pilot system.
5. Basic valve port shall be full-port (line size – same as flanges), unless otherwise designated in the written specification. Basic valve and pilot components shall be machined and assembled in the United States.
6. Electric solenoids, utilized as part of the pilot system, shall be commercially distributed throughout the United States, have manual overrides, and they shall be full ported, tube line size, and not piloted in series with accelerators.

PART 3 - EXECUTION

- A. All valves shall be carefully mounted in their respective positions free from distortion and strain. All valves shall be properly packed and left in satisfactory operating condition at the completion of the project.
- B. Valve box and cover shall be installed with each valve as shown in miscellaneous details.
- C. Valves shall be delivered to customer with O&M manual and accompanied with electrical application wiring schematic where applicable.

END OF SECTION